

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

APPLICANT: Joseph Peter Robert Tosey

SERIAL NO.: 10/687,218 CONFIRMATION NO.: 8112

FILING DATE: October 15, 2003

TITLE: Incremental Search of Keyword Strings

EXAMINER: Dennis Y. Myint TELEPHONE: (571) 272-5629  
FAX: (571) 273-8300

ART UNIT: 2162

---

Mail Stop Appeal Brief - Patents  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**APPEAL BRIEF**

Dear Sir:

This paper is in support of a Notice of Appeal filed February 28, 2008, of the Office  
Action dated November 28, 2007, to the Board of Patent Appeals and Interferences.

**Table of Contents**

|              |   |            |
|--------------|---|------------|
| <b>I.</b>    | <b>Real Party in Interest</b>   | <b>3</b>   |
| <b>II.</b>   | <b>Related Appeals and Interferences</b>  | <b>4</b>   |
| <b>III.</b>  | <b>Status of Claims</b>   | <b>5</b>   |
| <b>IV.</b>   | <b>Status of Amendments</b>   | <b>6</b>   |
| <b>V.</b>    | <b>Summary of Claimed Subject Matter</b>  | <b>7</b>   |
| <b>VI.</b>   | <b>Grounds of Rejection to be Reviewed on Appeal</b>  | <b>45</b>  |
| <b>VII.</b>  | <b>Argument</b>   | <b>46</b>  |
|              | Claims 1, 2, 13, 16-18, 21, 24-28, 32, 35-37, 40, 43, 45, 46, 57, 60-62, 65,<br>68-72, 76, 79-81, 84, 87, 89, 90, 101, 104-106, 109, 112-116, 120, 123-125,<br>128, 131, 133, 134, 142, 145-147, 150-155, 158-160, 163, 165, 166, 174,<br>177-179, 182, 182-187, 190-192, and 195 | <b>46</b>  |
|              | Claims 3-9, 47-53, 91-97, 135-141, and 167-173  | <b>53</b>  |
|              | Claims 14-15, 19-20, 22-23, 33-34, 38-39, 41-42, 58-59, 63-64, 66-67, 77-78,<br>82-83, 85-86, 102-103, 107-108, 110-111, 121-122, 126-127, 129-130,<br>143-144, 148-149, 156-157, 161-162, 175-176, 180-181, 188-189, and 193-194   | <b>53</b>  |
|              | Claims 44, 88, 132, 164, and 196  | <b>54</b>  |
|              | Claims 197- 206   | <b>57</b>  |
| <b>VIII.</b> | <b>Claims Appendix</b>  | <b>58</b>  |
| <b>IX.</b>   | <b>Evidence Appendix</b>  | <b>109</b> |
| <b>X.</b>    | <b>Related Proceedings Appendix</b>   | <b>110</b> |

**Real Party in Interest**

Sierra Wireless, Inc.

**Related Appeals and Interferences**

None.

**Status of Claims**

Claims 10-12, 29-31, 54-56, 73-75, 98-100, and 117-119 have been cancelled.

Claims 1-9, 13-28, 32-53, 57-72, 76-97, 101-116, and 120-206 have been finally rejected  
and are on appeal.

**Status of Amendments**

No amendments after final have been filed. All amendments have been entered.

**Summary of Claimed Subject Matter**

The claimed subject matter relates to the incremental search of keyword strings. (¶[0009], ll. 1-2). An input keyword string comprising one or more words having one or more symbols is received. (¶[0007], ll. 1-2). A bit vector is created based at least in part on the input keyword string. (¶[0007], ll. 2-3). The bit vector is compared with one or more other bit vectors representing at least one candidate keyword string, to create a set of matching bit vectors. (¶[0007], ll. 3-4). A keyword matching algorithm is applied to the at least one candidate keyword represented by the matching bit vectors. (¶[0007], ll. 5-6). Any matching candidate keyword strings are presented to a user. (¶[0007], ll. 6-7).

Claim 1 is directed to a method for creating a keyword string database on a wireless user device. The method includes determining one or more candidate keyword strings to store in the database. (FIG. 3, reference numeral 300; ¶[0025], ll. 2-5). The method also includes, for each of the one or more candidate keyword strings, creating a single bit vector based at least in part on the each of the one or more candidate keyword strings, the bit vectors for use in comparing an input bit vector with the bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings, the input keyword string provided by a user of the wireless user device. (FIG. 3, reference numeral 310; ¶[0025], ll. 5-6). The method also includes storing the one or more bit vectors and a reference to the one or more candidate keyword strings in the database. (FIG. 3, reference numeral 315; ¶[0025], ll. 6-7).

Claim 13 is directed to a method for incremental keyword search on a wireless user device. The method includes receiving from a user of the wireless user device an input keyword

string comprising one or more words comprising one or more symbols. (FIG. 5, reference numeral 500; ¶[0027], ll. 3-4). The method also includes creating a single bit vector based at least in part on the input keyword string. (FIG. 5, reference numeral 505; ¶[0027], ll. 4-5). The method also includes comparing the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors. (FIG. 5, reference numeral 510; ¶[0027], ll. 5-10). The method also includes applying a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors. (FIG. 5, reference numerals 515 and 520; ¶[0027], ll. 3-4). The method also includes presenting any matching candidate keyword strings. (FIG. 5, reference numerals 525 and 535; ¶[0027], ll. 12-15).

Claim 17 is directed to a method for creating a keyword string database on a wireless user device. The method includes determining one or more candidate keyword strings to store in the database. (FIG. 7, reference numeral 700; ¶[0034], ll. 4-6). The method also includes, for each of the one or more candidate keyword strings, creating a single bit vector based at least in part on the each of the one or more candidate keyword strings, the bit vector having a bit position for each symbol in an alphabet and having bits set for bit positions corresponding to at least one symbol representing the first symbol of a word in the each of the one or more candidate keyword strings, the bit vectors for use in comparing an input bit vector with the bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings. (FIG. 7, reference numeral 710; ¶[0034], ll. 6-8). The method also includes storing the one or more bit vectors and a reference to the one or more candidate keyword strings in the database. (FIG. 7, reference numeral 715; ¶[0034], ll. 8-9).



Claim 18 is directed to a method for incremental keyword search on a wireless user device. The method includes submitting to the wireless user device an input keyword string comprising one or more words comprising one or more symbols. (FIG. 4, reference numeral 400; ¶[0026], ll. 3-4). The method also includes receiving in response to the submitting at least one candidate keyword string where the first symbol of at least one word in each of the at least one candidate keyword string matches the first symbol of the corresponding word in the input keyword string. (FIG. 4, reference numeral 400; ¶[0026], ll. 4-8).

Claim 21 is directed to a method for incremental keyword search on a wireless user device. The method includes receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols. (FIG. 9, reference numeral 900; ¶[0038], ll. 3-4). The method also includes creating a single bit vector based at least in part on the input keyword string, the bit vector having a bit position for each symbol in an alphabet and having bits set for positions corresponding to at least one symbol representing the first symbol of a word in the input keyword string. (FIG. 9, reference numeral 905; ¶[0038], ll. 4-7). The method also includes comparing the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors. (FIG. 9, reference numeral 910; ¶[0038], ll. 7-12). The method also includes applying a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors. (FIG. 9, reference numerals 915 and 920; ¶[0038], ll. 12-14). The method also includes presenting any matching candidate keyword strings. (FIG. 9, reference numeral 935; ¶[0038], ll. 16-17).

Claim 25 is directed to a method for comparing keyword strings on a wireless user device. The method includes determining a relative frequency of use for at least one symbol in a language. (FIG. 12, reference numeral 1200; ¶[0042], ll. 3-6). The method also includes assigning a statistical weighting to the at least one symbol based at least in part on a relative frequency of use of the at least one symbol. (FIG. 12, reference numeral 1205; ¶[0042], ll. 6-7). The method also includes assigning each of the at least one symbol to one of a plurality of groups. (FIG. 12, reference numeral 1210; ¶[0042], ll. 7-10). The method also includes comparing a first keyword string and a second keyword string based at least in part on whether at least one symbol of the first keyword string is assigned to the same group as at least one corresponding symbol of the second keyword string. (FIG. 12, reference numeral 1215; ¶[0042], ll. 10-12; ¶[0043]). The method also includes presenting a result of the comparing to a user of the wireless user device.

Claim 28 is directed to a method for creating a keyword string database on a wireless user device. The method includes determining one or more candidate keyword strings to store in the database. (FIG. 13, reference numeral 1300; ¶[0044], ll. 3-4). The method also includes creating one or more bit vectors based at least in part on the one or more candidate keyword strings, each bit of the one or more bit vectors corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to the first symbol of a word in the one or more candidate keyword strings being set, the one or more bit vectors for use in comparing an input bit vector with the one or more bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings. (FIG. 13, reference numeral 1310; ¶[0044], ll. 5-7). The method also includes storing the one or more bit vectors and a

reference to the one or more candidate keyword strings in the database. (FIG. 13, reference numeral 1315; ¶[0044], ll. 7-8).

Claim 32 is directed to a method for incremental keyword search on a wireless user device. The method includes receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string. (FIG. 15, reference numeral 1500; ¶[0046], ll. 3-5).

The method also includes creating a single bit vector based at least in part on the input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to the one or more symbols being set. (FIG. 15, reference numeral 1505; ¶[0046], ll. 5-7). The method also includes comparing the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors. (FIG. 15, reference numeral 1510; ¶[0046], ll. 7-12). The method also includes applying a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors. (FIG. 15, reference numerals 1515 and 1520; ¶[0046], ll. 12-14). The method also includes presenting any matching candidate keyword strings. (FIG. 15, reference numerals 1525 and 1535; ¶[0046], ll. 14-16).

Claim 36 is directed to a method for creating a keyword string database on a wireless user device. The method includes determining one or more candidate keyword strings to store in the database. (FIG. 18, reference numeral 1800; ¶[0049], ll. 5-6). The method also includes creating one or more bit vectors based at least in part on the one or more candidate keyword strings, each bit of the one or more bit vectors corresponding to one or more symbols in an alphabet, bits

having a bit position corresponding to a symbol of a prefix of a word in the one or more candidate keyword strings being set, the one or more bit vectors for use in comparing an input bit vector with the one or more bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings. (FIG. 18, reference numeral 1810; ¶[0049], ll. 6-9). The method also includes storing the one or more bit vectors and a reference to the one or more candidate keyword strings in the database. (FIG. 18, reference numeral 1815; ¶[0049], ll. 9-10).

Claim 37 is directed to a method for incremental keyword search on a wireless user device. The method includes submitting an input keyword string comprising one or more words comprising one or more symbols. (FIG. 19, reference numeral 1900; ¶[0050], ll. 3-4). The method also includes receiving in response to the submitting at least one candidate keyword string where a prefix of a word of a matching candidate keyword string comprises at least one symbol that belongs to the same symbol group as the corresponding symbol of the corresponding word in the input keyword string. (FIG. 19, reference numeral 1905; ¶[0050], ll. 4-10).

Claim 40 is directed to a method for incremental keyword search on a wireless user device. The method includes receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols. (FIG. 20, reference numeral 2000; ¶[0051], ll. 3-4). The method also includes creating a single bit vector based at least in part on the input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to a prefix of a word in the one or more symbols being set. (FIG. 20, reference numeral 2005; ¶[0051], ll. 4-7). The method also includes

comparing the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors. (FIG. 20, reference numeral 2010; ¶[0051], ll. 7-12). The method also includes applying a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors. (FIG. 20, reference numerals 2015 and 2020; ¶[0051], ll. 12-14). The method also includes presenting any matching candidate keyword strings. (FIG. 20, reference numerals 2025 and 2035; ¶[0051], ll. 14-19).

Claim 44 is directed to a method for incremental keyword search on a wireless user device. The method includes receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string. (FIG. 24, reference numeral 2400; ¶[0060], ll. 3-4). The method also includes receiving a hierarchy, elements of the hierarchy comprising intermediate nodes and leaf nodes representing one or more keyword strings comprising one or more words comprising one or more symbols. (FIG. 24, reference numeral 2405; ¶[0060], ll. 4-6). The method also includes creating hierarchy bit vectors corresponding to the one or more keyword strings in the hierarchy. (FIG. 24, reference numeral 2410; ¶[0060], ll. 6-7). The method also includes searching the hierarchy bit vectors for a match with the input keyword string. (FIG. 24, reference numeral 2420; ¶[0060], ll. 8-9). The searching includes, for each of the elements of the hierarchy, saving the input keyword string (FIG. 25, reference numeral 2500; ¶[0061], l. 5), applying a logical “AND” operation to the bit vector of the element and a bit vector based at least in part on the input keyword string, the applying producing a result. (FIG. 25, reference numeral 2505; ¶[0061], ll. 5-7). The method also includes, if the result is nonzero,

removing from the input keyword string any words in the input keyword string that are prefixes of words in the element. (FIG. 25, reference numeral 2510; ¶[0061], ll. 7-8). The method also includes, if the input keyword string is empty, adding the element to a list of matched items. (FIG. 25, reference numeral 2520; ¶[0061], ll. 9-10). The method also includes restoring the input keyword string. (FIG. 25, reference numeral 2535; ¶[0061], l. 12). The method also includes rendering the list of matched items. (FIG. 25, reference numeral 2535; ¶[0061], l. 12).

Claim 45 is directed to a method for creating a keyword string database on a wireless user device. The method includes a step for determining one or more candidate keyword strings to store in the database. (FIG. 3, reference numeral 300; ¶[0025], ll. 2-5) The method also includes a step for, for each of the one or more candidate keyword strings, creating a single bit vector based at least in part on the each of the one or more candidate keyword strings, the bit vectors for use in comparing an input bit vector with the bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings, the input keyword string provided by a user of the wireless user device. (FIG. 3, reference numeral 310; ¶[0025], ll. 5-6) The method also includes a step for storing the one or more bit vectors and a reference to the one or more candidate keyword strings in the database. (FIG. 3, reference numeral 315; ¶[0025], ll. 6-7).

Claim 57 is directed to a method for incremental keyword search on a wireless user device. The method includes a step for receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols. (FIG. 5, reference numeral 500; ¶[0027], ll. 3-4). The method also includes a step for creating a single bit

vector based at least in part on the input keyword string. (FIG. 5, reference numeral 505; ¶[0027], ll. 4-5). The method also includes a step for comparing the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors. (FIG. 5, reference numeral 510; ¶[0027], ll. 5-10). The method also includes a step for applying a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors. (FIG. 5, reference numerals 515 and 520; ¶[0027], ll. 3-4). The method also includes a step for presenting any matching candidate keyword strings. (FIG. 5, reference numerals 525 and 535; ¶[0027], ll. 12-15).

Claim 61 is directed to a method for creating a keyword string database on a wireless user device. The method includes a step for determining one or more candidate keyword strings to store in the database. The method also includes a step for, for each of the one or more candidate keyword strings (FIG. 7, reference numeral 700; ¶[0034], ll. 4-6), creating a single bit vector based at least in part on the each of the one or more candidate keyword strings, the bit vector having a bit position for each symbol in an alphabet and having bits set for bit positions corresponding to at least one symbol representing the first symbol of a word in the each of the one or more candidate keyword strings, the bit vectors for use in comparing an input bit vector with the bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings. (FIG. 7, reference numeral 710; ¶[0034], ll. 6-8). The method also includes a step for storing the one or more bit vectors and a reference to the one or more candidate keyword strings in the database. (FIG. 7, reference numeral 715; ¶[0034], ll. 8-9).

Claim 62 is directed to a method for incremental keyword search on a wireless user device. The method includes a step for submitting to the wireless user device an input keyword string comprising one or more words comprising one or more symbols. (FIG. 4, reference numeral 400; ¶[0026], ll. 3-4). The method also includes a step for receiving in response to the submitting at least one candidate keyword string where the first symbol of at least one word in each of the at least one candidate keyword string matches the first symbol of the corresponding word in the input keyword string. (FIG. 4, reference numeral 400; ¶[0026], ll. 4-8).

Claim 65 is directed to a method for incremental keyword search on a wireless user device. The method includes a step for receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols. (FIG. 9, reference numeral 900; ¶[0038], ll. 3-4). The method also includes a step for creating a single bit vector based at least in part on the input keyword string, the bit vector having a bit position for each symbol in an alphabet and having bits set for positions corresponding to at least one symbol representing the first symbol of a word in the input keyword string. (FIG. 9, reference numeral 905; ¶[0038], ll. 4-7). The method also includes a step for comparing the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors. (FIG. 9, reference numeral 910; ¶[0038], ll. 7-12). The method also includes a step for applying a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors. FIG. 9, reference numerals 915 and 920; ¶[0038], ll. 12-14). The method also includes a step for presenting any matching candidate keyword strings. (FIG. 9, reference numeral 935; ¶[0038], ll. 16-17).



Claim 69 is directed to a method for comparing keyword strings on a wireless user device. The method includes a step for determining a relative frequency of use for at least one symbol in a language. (FIG. 12, reference numeral 1200; ¶[0042], ll. 3-6). The method also includes a step for assigning a statistical weighting to the at least one symbol based at least in part on a relative frequency of use of the at least one symbol. (FIG. 12, reference numeral 1205; ¶[0042], ll. 6-7). The method also includes a step for assigning each of the at least one symbol to one of a plurality of groups. (FIG. 12, reference numeral 1210; ¶[0042], ll. 7-10). The method also includes a step for comparing a first keyword string and a second keyword string based at least in part on whether at least one symbol of the first keyword string is assigned to the same group as at least one corresponding symbol of the second keyword string. (FIG. 12, reference numeral 1215; ¶[0042], ll. 10-12; ¶[0043]). The method also includes a step for presenting a result of the comparing to a user of the wireless user device.

Claim 72 is directed to a method for creating a keyword string database on a wireless user device. The method includes a step for determining one or more candidate keyword strings to store in the database. (FIG. 13, reference numeral 1300; ¶[0044], ll. 3-4). The method also includes a step for creating one or more bit vectors based at least in part on the one or more candidate keyword strings, each bit of the one or more bit vectors corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to the first symbol of a word in the one or more candidate keyword strings being set, the one or more bit vectors for use in comparing an input bit vector with the one or more bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings. (FIG. 13, reference numeral 1310; ¶[0044], ll. 5-7). The method also includes a step for

storing the one or more bit vectors and a reference to the one or more candidate keyword strings in the database. (FIG. 13, reference numeral 1315; ¶[0044], ll. 7-8).

Claim 76 is directed to a method for incremental keyword search on a wireless user device. The method includes a step for receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string. (FIG. 15, reference numeral 1500; ¶[0046], ll. 3-5). The method also includes a step for creating a single bit vector based at least in part on the input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to the one or more symbols being set. (FIG. 15, reference numeral 1505; ¶[0046], ll. 5-7). The method also includes a step for comparing the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors. (FIG. 15, reference numeral 1510; ¶[0046], ll. 7-12). The method also includes a step for applying a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors. (FIG. 15, reference numerals 1515 and 1520; ¶[0046], ll. 12-14). The method also includes a step for presenting any matching candidate keyword strings. (FIG. 15, reference numerals 1525 and 1535; ¶[0046], ll. 14-16).

Claim 80 is directed to a method for creating a keyword string database on a wireless user device. The method includes a step for determining one or more candidate keyword strings to store in the database. (FIG. 18, reference numeral 1800; ¶[0049], ll. 5-6). The method also includes a step for creating one or more bit vectors based at least in part on the one or more

candidate keyword strings, each bit of the one or bit vector corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to a symbol of a prefix of a word in the one or more candidate keyword strings being set, the one or more bit vectors for use in comparing an input bit vector with the one or more bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings. (FIG. 18, reference numeral 1810; ¶[0049], ll. 6-9). The method also includes a step for storing the one or more bit vectors and a reference to the one or more candidate keyword strings in the database. (FIG. 18, reference numeral 1815; ¶[0049], ll. 9-10).

Claim 81 is directed to a method for incremental keyword search on a wireless user device. The method includes a step for submitting an input keyword string comprising one or more words comprising one or more symbols. (FIG. 19, reference numeral 1900; ¶[0050], ll. 3-4). The method also includes a step for receiving in response to the submitting at least one candidate keyword string where a prefix of a word of a matching candidate keyword string comprises at least one symbol that belongs to the same symbol group as the corresponding symbol of the corresponding word in the input keyword string. (FIG. 19, reference numeral 1905; ¶[0050], ll. 4-10).

Claim 84 is directed to a method for incremental keyword search on a wireless user device. The method includes a step for receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols. (FIG. 20, reference numeral 2000; ¶[0051], ll. 3-4). The method also includes a step for creating a single bit vector based at least in part on the input keyword string, each bit corresponding to one or

more symbols in an alphabet, bits having a bit position corresponding to a prefix of a word in the one or more symbols being set. (FIG. 20, reference numeral 2005; ¶[0051], ll. 4-7). The method also includes a step for comparing the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors. (FIG. 20, reference numeral 2010; ¶[0051], ll. 7-12). The method also includes a step for applying a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors. (FIG. 20, reference numerals 2015 and 2020; ¶[0051], ll. 12-14). The method also includes a step for presenting any matching candidate keyword strings. (FIG. 20, reference numerals 2025 and 2035; ¶[0051], ll. 14-19).

Claim 88 is directed to a method for incremental keyword search on a wireless user device. The method includes a step for receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string. (FIG. 24, reference numeral 2400; ¶[0060], ll. 3-4). The method also includes a step for receiving a hierarchy, elements of the hierarchy comprising intermediate nodes and leaf nodes representing one or more keyword strings comprising one or more words comprising one or more symbols. (FIG. 24, reference numeral 2405; ¶[0060], ll. 4-6). The method also includes a step for creating hierarchy bit vectors corresponding to the one or more keyword strings in the hierarchy. (FIG. 24, reference numeral 2410; ¶[0060], ll. 6-7). The method also includes a step for searching the hierarchy bit vectors for a match with the input keyword string (FIG. 24, reference numeral 2420; ¶[0060], ll. 8-9), the a step for searching comprising, for each of the elements of the hierarchy:

a step for saving the input keyword string (FIG. 25, reference numeral 2500; ¶[0061], l. 5), a step for applying a logical “AND” operation to the bit vector of the element and a bit vector based at least in part on the input keyword string, the applying producing a result (FIG. 25, reference numeral 2505; ¶[0061], ll. 5-7), a step for if the result is nonzero, removing from the input keyword string any words in the input keyword string that are prefixes of words in the element (FIG. 25, reference numeral 2510; ¶[0061], ll. 7-8), a step for if the input keyword string is empty, adding the element to a list of matched items (FIG. 25, reference numeral 2520; ¶[0061], ll. 9-10), and a step for restoring the input keyword string (FIG. 25, reference numeral 2535; ¶[0061], l. 12). The method also includes a step for rendering the list of matched items. (FIG. 24, reference numeral 2425; ¶[0060], l. 9).

Claim 89 is directed to a program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for creating a keyword string database on a wireless user device. (¶[0010]). The method includes determining one or more candidate keyword strings to store in the database. (FIG. 3, reference numeral 300; ¶[0025], ll. 2-5). The method also includes, for each of the one or more candidate keyword strings, creating a single bit vector based at least in part on the each of the one or more candidate keyword strings, the bit vectors for use in comparing an input bit vector with the bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings, the input keyword string provided by a user of the wireless user device. (FIG. 3, reference numeral 310; ¶[0025], ll. 5-6). The method also includes storing the one or more bit vectors and a reference to the one or more candidate keyword strings in the database. (FIG. 3, reference numeral 315; ¶[0025], ll. 6-7).

Claim 101 is directed to a program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for incremental keyword search on a wireless user device. (¶[0010]). The method includes receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols. (FIG. 5, reference numeral 500; ¶[0027], ll. 3-4). The method also includes creating a single bit vector based at least in part on the input keyword string. (FIG. 5, reference numeral 505; ¶[0027], ll. 4-5). The method also includes comparing the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors. (FIG. 5, reference numeral 510; ¶[0027], ll. 5-10). The method also includes applying a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors. (FIG. 5, reference numerals 515 and 520; ¶[0027], ll. 3-4). The method also includes presenting any matching candidate keyword strings. (FIG. 5, reference numerals 525 and 535; ¶[0027], ll. 12-15).

Claim 105 is directed to a program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for creating a keyword string database on a wireless user device. (¶[0010]). The method includes determining one or more candidate keyword strings to store in the database. (FIG. 7, reference numeral 700; ¶[0034], ll. 4-6). The method also includes for each of the one or more candidate keyword strings, creating a single bit vector based at least in part on the each of the one or more candidate keyword strings, the bit vector having a bit position for each symbol in an alphabet and having bits set for bit positions corresponding to at least one symbol representing the first symbol of a word in the each of the one or more candidate keyword strings, the bit vectors for use in

comparing an input bit vector with the bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings. FIG. 7, reference numeral 710; ¶[0034], ll. 6-8). The method also includes storing the one or more bit vectors and a reference to the one or more candidate keyword strings in the database. (FIG. 7, reference numeral 715; ¶[0034], ll. 8-9).

Claim 106 is directed to a program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for incremental keyword search on a wireless user device. (¶[0010]). The method includes submitting to the wireless user device an input keyword string comprising one or more words comprising one or more symbols. (FIG. 4, reference numeral 400; ¶[0026], ll. 3-4). The method also includes receiving in response to the submitting at least one candidate keyword string where the first symbol of at least one word in each of the at least one candidate keyword string matches the first symbol of the corresponding word in the input keyword string. (FIG. 4, reference numeral 400; ¶[0026], ll. 4-8).

Claim 109 is directed to a program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for incremental keyword search on a wireless user device. (¶[0010]). The method includes receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols. (FIG. 9, reference numeral 900; ¶[0038], ll. 3-4) The method also includes creating a single bit vector based at least in part on the input keyword string, the bit vector having a bit position for each symbol in an alphabet and having bits set for positions

corresponding to at least one symbol representing the first symbol of a word in the input keyword string. (FIG. 9, reference numeral 905; ¶[0038], ll. 4-7). The method also includes comparing the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors. (FIG. 9, reference numeral 910; ¶[0038], ll. 7-12). The method also includes applying a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors. (FIG. 9, reference numerals 915 and 920; ¶[0038], ll. 12-14). The method also includes presenting any matching candidate keyword strings. (FIG. 9, reference numeral 935; ¶[0038], ll. 16-17).

Claim 113 is directed to a program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for comparing keyword strings on a wireless user device. (¶[0010]). The method includes determining a relative frequency of use for at least one symbol in a language. (FIG. 12, reference numeral 1200; ¶[0042], ll. 3-6). The method also includes assigning a statistical weighting to the at least one symbol based at least in part on a relative frequency of use of the at least one symbol. (FIG. 12, reference numeral 1205; ¶[0042], ll. 6-7). The method also includes assigning each of the at least one symbol to one of a plurality of groups. (FIG. 12, reference numeral 1210; ¶[0042], ll. 7-10). The method also includes comparing a first keyword string and a second keyword string based at least in part on whether at least one symbol of the first keyword string is assigned to the same group as at least one corresponding symbol of the second keyword string. (FIG. 12, reference numeral 1215; ¶[0042], ll. 10-12; ¶[0043]).



Claim 116 is directed to a program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for creating a keyword string database on a wireless user device. (§[0010]). The method includes determining one or more candidate keyword strings to store in the database. (FIG. 13, reference numeral 1300; §[0044], ll. 3-4). The method also includes creating one or more bit vectors based at least in part on the one or more candidate keyword strings, each bit of the one or more bit vectors corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to the first symbol of a word in the one or more candidate keyword strings being set, the one or more bit vectors for use in comparing an input bit vector with the one or more bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings. (FIG. 13, reference numeral 1310; §[0044], ll. 5-7). The method also includes storing the one or more bit vectors and a reference to the one or more candidate keyword strings in the database. (FIG. 13, reference numeral 1315; §[0044], ll. 7-8).

Claim 120 is directed to a program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for incremental keyword search on a wireless user device. (§[0010]). The method includes receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string. (FIG. 15, reference numeral 1500; §[0046], ll. 3-5). The method also includes creating a single bit vector based at least in part on the input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to the one or more symbols being set. (FIG. 15, reference numeral 1505; §[0046], ll. 5-7). The method also includes comparing the bit

vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors. (FIG. 15, reference numeral 1510; ¶[0046], ll. 7-12). The method also includes applying a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors. (FIG. 15, reference numerals 1515 and 1520; ¶[0046], ll. 12-14). The method also includes presenting any matching candidate keyword strings. (FIG. 15, reference numerals 1525 and 1535; ¶[0046], ll. 14-16).

Claim 124 is directed to a program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for creating a keyword string database on a wireless user device. (¶[0010]). The method includes determining one or more candidate keyword strings to store in the database. (FIG. 18, reference numeral 1800; ¶[0049], ll. 5-6). The method also includes creating one or more bit vectors based at least in part on the one or more candidate keyword strings, each bit of the one or bit vector corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to a symbol of a prefix of a word in the one or more candidate keyword strings being set, the one or more bit vectors for use in comparing an input bit vector with the one or more bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings. (FIG. 18, reference numeral 1810; ¶[0049], ll. 6-9). The method also includes storing the one or more bit vectors and a reference to the one or more candidate keyword strings in the database. (FIG. 18, reference numeral 1815; ¶[0049], ll. 9-10).

Claim 125 is directed to a program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for incremental keyword

search on a wireless user device. (¶[0010]). The method includes submitting an input keyword string comprising one or more words comprising one or more symbols. (FIG. 19, reference numeral 1900; ¶[0050], ll. 3-4). The method also includes receiving in response to the submitting at least one candidate keyword string where a prefix of a word of a matching candidate keyword string comprises at least one symbol that belongs to the same symbol group as the corresponding symbol of the corresponding word in the input keyword string. (FIG. 19, reference numeral 1905; ¶[0050], ll. 4-10).

Claim 128 is directed to a program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for incremental keyword search on a wireless user device. (¶[0010]). The method includes receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols. (FIG. 20, reference numeral 2000; ¶[0051], ll. 3-4). The method also includes creating a single bit vector based at least in part on the input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to a prefix of a word in the one or more symbols being set. (FIG. 20, reference numeral 2005; ¶[0051], ll. 4-7). The method also includes comparing the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors. (FIG. 20, reference numeral 2010; ¶[0051], ll. 7-12). The method also includes applying a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors. (FIG. 20, reference numerals 2015 and 2020; ¶[0051], ll. 12-14). The method also includes presenting any matching candidate keyword strings. (FIG. 20, reference numerals 2025 and 2035; ¶[0051], ll. 14-19).

Claim 132 is directed to a program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for incremental keyword search on a wireless user device. (§[0010]). The method includes receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string. (FIG. 24, reference numeral 2400; §[0060], ll. 3-4). The method also includes receiving a hierarchy, elements of the hierarchy comprising intermediate nodes and leaf nodes representing one or more keyword strings comprising one or more words comprising one or more symbols. (FIG. 24, reference numeral 2405; §[0060], ll. 4-6). The method also includes creating hierarchy bit vectors corresponding to the one or more keyword strings in the hierarchy. (FIG. 24, reference numeral 2410; §[0060], ll. 6-7). The method also includes searching the hierarchy bit vectors for a match with the input keyword string (FIG. 24, reference numeral 2420; §[0060], ll. 8-9), the searching comprising, for each of the elements of the hierarchy: saving the input keyword string (FIG. 25, reference numeral 2500; §[0061], l. 5), applying a logical “AND” operation to the bit vector of the element and a bit vector based at least in part on the input keyword string, the applying producing a result (FIG. 25, reference numeral 2505; §[0061], ll. 5-7), if the result is nonzero, removing from the input keyword string any words in the input keyword string that are prefixes of words in the element (FIG. 25, reference numeral 2510; §[0061], ll. 7-8), if the input keyword string is empty, adding the element to a list of matched items (FIG. 25, reference numeral 2520; §[0061], ll. 9-10), and restoring the input keyword string. (FIG. 25, reference numeral 2535; §[0061], l. 12). The method also includes rendering the list of matched items. (FIG. 24, reference numeral 2425; §[0060], l. 9).

Claim 133 is directed to an apparatus for creating a keyword string database on a wireless user device. The apparatus includes means (¶¶[0011]-[0012]; processor 104) for determining one or more candidate keyword strings to store in the database (keyword string database 208). (FIG. 3, reference numeral 300; ¶[0025], ll. 2-5) The apparatus also includes means (¶¶[0011]-[0012]; processor 104) for, for each of the one or more candidate keyword strings, creating a single bit vector based at least in part on the each of the one or more candidate keyword strings, the bit vectors for use in comparing an input bit vector with the bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings, the input keyword string provided by a user of the wireless user device (wireless user device 200). (FIG. 3, reference numeral 310; ¶[0025], ll. 5-6). The apparatus also includes means (¶¶[0011]-[0012]; processor 104) for storing the one or more bit vectors and a reference to the one or more candidate keyword strings in the database (keyword string database 208). (FIG. 3, reference numeral 315; ¶[0025], ll. 6-7).

Claim 142 is directed to an apparatus for incremental keyword search on a wireless user device. The apparatus includes means (¶¶[0011]-[0012]; user interface 206) for receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols. (FIG. 5, reference numeral 500; ¶[0027], ll. 3-4) The apparatus also includes means (¶¶[0011]-[0012]; search engine 204) for creating a single bit vector based at least in part on the input keyword string. (FIG. 5, reference numeral 505; ¶[0027], ll. 4-5). The apparatus also includes means (¶¶[0011]-[0012]; search engine 204) for comparing the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors. (FIG. 5, reference numeral 510; ¶[0027],

ll. 5-10). The apparatus also includes means (¶¶[0011]-[0012]; search engine 204) for applying a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors. (FIG. 5, reference numerals 515 and 520; ¶[0027], ll. 3-4). The apparatus also includes means (¶¶[0011]-[0012]; user interface 206) for presenting any matching candidate keyword strings. (FIG. 5, reference numerals 525 and 535; ¶[0027], ll. 12-15).

Claim 146 is directed to an apparatus for creating a keyword string database on a wireless user device. The apparatus includes means (¶¶[0011]-[0012]; processor 104) for determining one or more candidate keyword strings to store in the database. (FIG. 7, reference numeral 700; ¶[0034], ll. 4-6). The apparatus also includes means (¶¶[0011]-[0012]; processor 104) for, for each of the one or more candidate keyword strings, creating a single bit vector based at least in part on the each of the one or more candidate keyword strings, the bit vector having a bit position for each symbol in an alphabet and having bits set for bit positions corresponding to at least one symbol representing the first symbol of a word in the each of the one or more candidate keyword strings, the bit vectors for use in comparing an input bit vector with the bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings. (FIG. 7, reference numeral 710; ¶[0034], ll. 6-8). The apparatus also includes means (¶¶[0011]-[0012]; processor 104) for storing the one or more bit vectors and a reference to the one or more candidate keyword strings in the database. (FIG. 7, reference numeral 715; ¶[0034], ll. 8-9).

Claim 147 is directed to an apparatus for incremental keyword search on a resource-constrained device. The apparatus includes means (¶¶[0011]-[0012]; user interface 206) for receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols. (FIG. 9, reference numeral 900; ¶[0038], ll. 3-4). The apparatus also includes means (¶¶[0011]-[0012]; search engine 204) for creating a single bit vector based at least in part on the input keyword string, the bit vector having a bit position for each symbol in an alphabet and having bits set for positions corresponding to at least one symbol representing the first symbol of a word in the input keyword string. (FIG. 9, reference numeral 905; ¶[0038], ll. 4-7). The apparatus also includes means (¶¶[0011]-[0012]; search engine 204) for comparing the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors. (FIG. 9, reference numeral 910; ¶[0038], ll. 7-12). The apparatus also includes means (¶¶[0011]-[0012]; search engine 204) for applying a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors. (FIG. 9, reference numerals 915 and 920; ¶[0038], ll. 12-14). The apparatus also includes means (¶¶[0011]-[0012]; user interface 206) for presenting any matching candidate keyword strings. (FIG. 9, reference numeral 935; ¶[0038], ll. 16-17).

Claim 151 is directed to an apparatus for comparing keyword strings on a wireless user device. The apparatus includes means (¶¶[0011]-[0012]; processor 104) for determining a relative frequency of use for at least one symbol in a language. (FIG. 12, reference numeral 1200; ¶[0042], ll. 3-6). The apparatus also includes means (¶¶[0011]-[0012]; processor 104) for assigning a statistical weighting to the at least one symbol based at least in part on a relative

frequency of use of the at least one symbol. (FIG. 12, reference numeral 1205; ¶[0042], ll. 6-7). The apparatus also includes means (¶[0011]-[0012]; processor 104) for assigning each of the at least one symbol to one of a plurality of groups. (FIG. 12, reference numeral 1210; ¶[0042], ll. 7-10). The apparatus also includes means (¶[0011]-[0012]; processor 104) for comparing a first keyword string and a second keyword string based at least in part on whether at least one symbol of the first keyword string is assigned to the same group as at least one corresponding symbol of the second keyword string. (FIG. 12, reference numeral 1215; ¶[0042], ll. 10-12; ¶[0043]).

Claim 154 is directed to an apparatus for creating a keyword string database on a wireless user device. The apparatus includes means (¶[0011]-[0012]; processor 104) for determining one or more candidate keyword strings to store in the database. (FIG. 13, reference numeral 1300; ¶[0044], ll. 3-4). The apparatus also includes means (¶[0011]-[0012]; processor 104) for creating one or more bit vectors based at least in part on the one or more candidate keyword strings, each bit of the one or more bit vectors corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to the first symbol of a word in the one or more candidate keyword strings being set, the one or more bit vectors for use in comparing an input bit vector with the one or more bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings. (FIG. 13, reference numeral 1310; ¶[0044], ll. 5-7). The apparatus also includes means (¶[0011]-[0012]; processor 104) for storing the one or more bit vectors and a reference to the one or more candidate keyword strings in the database. (FIG. 13, reference numeral 1315; ¶[0044], ll. 7-8).



Claim 155 is directed to an apparatus for incremental keyword search on a wireless user device. The apparatus includes means (¶¶[0011]-[0012]; user interface 206) for receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string. (FIG. 15, reference numeral 1500; ¶[0046], ll. 3-5). The apparatus also includes means (¶¶[0011]-[0012]; search engine 204) for creating a single bit vector based at least in part on the input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to the one or more symbols being set. (FIG. 15, reference numeral 1505; ¶[0046], ll. 5-7). The apparatus also includes means (¶¶[0011]-[0012]; search engine 204) for comparing the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors. (FIG. 15, reference numeral 1510; ¶[0046], ll. 7-12). The apparatus also includes means (¶¶[0011]-[0012]; search engine 204) for applying a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors. (FIG. 15, reference numerals 1515 and 1520; ¶[0046], ll. 12-14). The apparatus also includes means (¶¶[0011]-[0012]; user interface 206) for presenting any matching candidate keyword strings. (FIG. 15, reference numerals 1525 and 1535; ¶[0046], ll. 14-16).

Claim 159 is directed to an apparatus for creating a keyword string database on a wireless user device. The apparatus includes means (¶¶[0011]-[0012]; processor 104) for determining one or more candidate keyword strings to store in the database. (FIG. 18, reference numeral 1800; ¶[0049], ll. 5-6). The apparatus also includes means (¶¶[0011]-[0012]; processor 104) for creating one or more bit vectors based at least in part on the one or more candidate keyword

strings, each bit of the one or bit vector corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to a symbol of a prefix of a word in the one or more candidate keyword strings being set, the one or more bit vectors for use in comparing an input bit vector with the one or more bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings. (FIG. 18, reference numeral 1810; ¶[0049], ll. 6-9). The apparatus also includes means (¶[0011]-[0012]; processor 104) for storing the one or more bit vectors and a reference to the one or more candidate keyword strings in the database. (FIG. 18, reference numeral 1815; ¶[0049], ll. 9-10).

Claim 160 is directed to an apparatus for incremental keyword search on a wireless user device. The apparatus includes means (¶[0011]-[0012]; user interface 206) for receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols. (FIG. 20, reference numeral 2000; ¶[0051], ll. 3-4). The apparatus also includes means (¶[0011]-[0012]; search engine 204) for creating a bit vector based at least in part on the input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to a prefix of a word in the one or more symbols being set. (FIG. 20, reference numeral 2005; ¶[0051], ll. 4-7). The apparatus also includes means (¶[0011]-[0012]; search engine 204) for comparing the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors. (FIG. 20, reference numeral 2010; ¶[0051], ll. 7-12). The apparatus also includes means (¶[0011]-[0012]; search engine 204) for applying a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors. (FIG. 20, reference numerals 2015 and 2020; ¶[0051], ll. 12-14). The

apparatus also includes means (¶¶[0011]-[0012]; user interface 206) for presenting any matching candidate keyword strings. (FIG. 20, reference numerals 2025 and 2035; ¶[0051], ll. 14-19).

Claim 164 is directed to an apparatus for incremental keyword search on a wireless user device. The apparatus includes means (¶¶[0011]-[0012]; user interface 206) for receiving from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string. (FIG. 24, reference numeral 2400; ¶[0060], ll. 3-4). The apparatus also includes means (¶¶[0011]-[0012]; user interface 206) for receiving a hierarchy, elements of the hierarchy comprising intermediate nodes and leaf nodes representing one or more keyword strings comprising one or more words comprising one or more symbols. (FIG. 24, reference numeral 2405; ¶[0060], ll. 4-6). The apparatus also includes means (¶¶[0011]-[0012]; search engine 204) for creating hierarchy bit vectors corresponding to the one or more keyword strings in the hierarchy. FIG. 24, reference numeral 2410; ¶[0060], ll. 6-7). The apparatus also includes means (¶¶[0011]-[0012]; search engine 204) for searching the hierarchy bit vectors for a match with the input keyword string (FIG. 24, reference numeral 2420; ¶[0060], ll. 8-9), the means for searching comprising, for each of the elements of the hierarchy: means (¶¶[0011]-[0012]; search engine 204) for saving the input keyword string (FIG. 25, reference numeral 2500; ¶[0061], l. 5), means for applying a logical “AND” operation to the bit vector of the element and a bit vector based at least in part on the input keyword string, the applying producing a result (FIG. 25, reference numeral 2505; ¶[0061], ll. 5-7), means (¶¶[0011]-[0012]; search engine 204) for if the result is nonzero, removing from the input keyword string any words in the input keyword string that are prefixes of words in the element (FIG. 25, reference numeral 2510; ¶[0061], ll. 7-8), means

(¶¶[0011]-[0012]; search engine 204) for if the input keyword string is empty, adding the element to a list of matched items (FIG. 25, reference numeral 2520; ¶[0061], ll. 9-10), and means (¶¶[0011]-[0012]; search engine 204) for restoring the input keyword string. (FIG. 25, reference numeral 2535; ¶[0061], l. 12). The apparatus also includes means (¶¶[0011]-[0012]; user interface 206) for rendering the list of matched items. (FIG. 25, reference numeral 2535; ¶[0061], l. 12).

Claim 165 is directed to an apparatus for creating a keyword string database on a wireless user device. The apparatus includes a memory (FIG. 1, reference numerals 106 and 122) for storing the keyword string database (FIG. 2, reference numeral 208). The apparatus also includes a processor (FIG. 1, reference numeral 104) configured to determine one or more candidate keyword strings to store in the database (FIG. 2, reference numeral 208). The processor (FIG. 1, reference numeral 104) is also configured to, for each of the one or more candidate keyword strings, create a single bit vector based at least in part on the each of the one or more candidate keyword strings, the bit vectors for use in comparing an input bit vector with the bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings, the input keyword string provided by a user of the wireless user device. The processor (FIG. 1, reference numeral 104) is also configured to store the one or more bit vectors and a reference to the one or more candidate keyword strings in the database (FIG. 2, reference numeral 208).

Claim 174 is directed to an apparatus for incremental keyword search on a wireless user device. The apparatus includes a user interface (FIG. 2, reference numeral 206) configured to

receive from a user of the wireless user device (FIG. 2, reference numeral 200) an input keyword string (FIG. 2, reference numeral 210) comprising one or more words comprising one or more symbols, the user interface (FIG. 2, reference numeral 206) further configured to present any matching keyword strings (FIG. 2, reference numeral 220). The apparatus also includes a search engine (FIG. 2, reference numeral 204) in communication with the user interface (FIG. 2, reference numeral 206) and configured to create a single bit vector (FIG. 2, reference numeral 214) based at least in part on the input keyword string (FIG. 2, reference numerals 210 and 212), compare the bit vector (FIG. 2, reference numeral 214) with one or more other bit vectors (FIG. 2, reference numerals 222-228) representing at least one candidate keyword string to create a set of matching bit vectors, and apply a conventional keyword matching algorithm to the at least one candidate keyword string (FIG. 2, reference numeral 216) represented by the set of matching bit vectors.

Claim 178 is directed to an apparatus for creating a keyword string database on a wireless user device. The apparatus includes a memory (FIG. 1, reference numerals 106 and 122) for storing the keyword string database (FIG. 2, reference numeral 208). The apparatus also includes a processor (FIG. 1, reference numeral 104) configured to determine one or more candidate keyword strings to store in the database (FIG. 2, reference numeral 208). The processor (FIG. 1, reference numeral 104) is further configured to, for each of the one or more candidate keyword strings, create a single bit vector based at least in part on the each of the one or more candidate keyword strings, the bit vector having a bit position for each symbol in an alphabet and having bits set for bit positions corresponding to at least one symbol representing the first symbol of a word in the each of the one or more candidate keyword strings, the bit

vectors for use in comparing an input bit vector with the bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings. The processor (FIG. 1, reference numeral 104) is further configured to store the one or more bit vectors and a reference to the one or more candidate keyword strings in the database (FIG. 2, reference numeral 208).

Claim 179 is directed to an apparatus for incremental keyword search on a wireless user device. The apparatus includes a user interface (FIG. 2, reference numeral 206) configured to receive from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols. The user interface (FIG. 2, reference numeral 206) is further configured to present any matching keyword strings. The apparatus also includes a search engine (FIG. 2, reference numeral 204) in communication with the user interface (FIG. 2, reference numeral 206) and configured to create a single bit vector based at least in part on the input keyword string, the bit vector having a bit position for each symbol in an alphabet and having bits set for positions corresponding to at least one symbol representing the first symbol of a word in the input keyword string. The search engine (FIG. 2, reference numeral 204) is further configured to compare the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors, and apply a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors.

Claim 183 is directed to an apparatus for comparing keyword strings on a wireless user device. The apparatus includes a memory (FIG. 1, reference numerals 106 and 122) for storing

at least one relative frequency of use for at least one symbol in a language. The apparatus also includes a processor (FIG. 1, reference numeral 104) configured to determine a relative frequency of use for at least one symbol in a language, assign a statistical weighting to the at least one symbol based at least in part on a relative frequency of use of the at least one symbol, assign each of the at least one symbol to one of a plurality of groups, and compare a first keyword string and a second keyword string based at least in part on whether at least one symbol of the first keyword string is assigned to the same group as at least one corresponding symbol of the second keyword string.

Claim 186 is directed to an apparatus for creating a keyword string database on a wireless user device. The apparatus includes a memory (FIG. 1, reference numerals 106 and 122) for storing the keyword string database (FIG. 2, reference numeral 208). The apparatus also includes a processor (FIG. 1, reference numeral 104) configured to determine one or more candidate keyword strings to store in the database (FIG. 2, reference numeral 208). The processor (FIG. 1, reference numeral 104) is further configured to create one or more bit vectors based at least in part on the one or more candidate keyword strings, each bit of the one or more bit vectors corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to the first symbol of a word in the one or more candidate keyword strings being set, the one or more bit vectors for use in comparing an input bit vector with the one or more bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings. The processor (FIG. 1, reference numeral 104) is further configured to store the one or more bit vectors and a reference to the one or more candidate keyword strings in the database (FIG. 2, reference numeral 208).

Claim 187 is directed to an apparatus for incremental keyword search on a wireless user device. The apparatus includes a user interface (FIG. 2, reference numeral 206) configured to receive from a user of the wireless user device (FIG. 2, reference numeral 200) an input keyword string (FIG. 2, reference numeral 210) comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string. The user interface (FIG. 2, reference numeral 206) is further configured to present any matching keyword strings. The apparatus also includes a search engine (FIG. 2, reference numeral 204) in communication with the user interface (FIG. 2, reference numeral 206) and configured to create a single bit vector based at least in part on the input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to the one or more symbols being set. The search engine is further configured to compare the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors. The search engine (FIG. 2, reference numeral 204) is further configured to apply a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors.

Claim 191 is directed to an apparatus for creating a keyword string database on a wireless user device. The apparatus includes a memory (FIG. 1, reference numerals 106 and 122) for storing the keyword string database (FIG. 2, reference numeral 208). The apparatus also includes a processor (FIG. 1, reference numeral 104) configured to determine one or more candidate keyword strings to store in the database (FIG. 2, reference numeral 208). The processor (FIG. 1, reference numeral 104) is further configured to create one or more bit vectors based at least in part on the one or more candidate keyword strings, each bit of the one or bit



vector corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to a symbol of a prefix of a word in the one or more candidate keyword strings being set, the one or more bit vectors for use in comparing an input bit vector with the one or more bit vectors to indicate whether an input keyword string represented by the input bit vector matches the one or more candidate keyword strings. The processor (FIG. 1, reference numeral 104) is further configured to store the one or more bit vectors and a reference to the one or more candidate keyword strings in the database (FIG. 2, reference numeral 208).

Claim 192 is directed to an apparatus for incremental keyword search on a wireless user device. The apparatus includes a user interface (FIG. 2, reference numeral 206) configured to receive from a user of the wireless user device (FIG. 2, reference numeral 200) an input keyword string comprising one or more words comprising one or more symbols. The user interface (FIG. 2, reference numeral 206) is further configured to present any matching keyword strings. The apparatus also includes a search engine (FIG. 2, reference numeral 204) in communication with the user interface (FIG. 2, reference numeral 206) and configured to create a bit vector based at least in part on the input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to a prefix of a word in the one or more symbols being set. The search engine (FIG. 2, reference numeral 204) is further configured to compare the bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors, and apply a conventional keyword matching algorithm to the at least one candidate keyword string represented by the set of matching bit vectors.

Claim 196 is directed to an apparatus for incremental keyword search on a wireless user device. The apparatus includes a user interface (FIG. 2, reference numeral 206) configured to receive from a user of the wireless user device an input keyword string comprising one or more words comprising one or more symbols. The user interface (FIG. 2, reference numeral 206) is further configured to present any matching keyword strings. The apparatus also includes a search engine (FIG. 2, reference numeral 204) in communication with the user interface and configured to receive an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string. The search engine (FIG. 2, reference numeral 204) is further configured to receive a hierarchy, elements of the hierarchy comprising intermediate nodes and leaf nodes representing one or more keyword strings comprising one or more words comprising one or more symbols. The search engine (FIG. 2, reference numeral 204) is further configured to create hierarchy bit vectors corresponding to the one or more keyword strings in the hierarchy. The search engine (FIG. 2, reference numeral 204) is further configured to search the hierarchy bit vectors for a match with the input keyword string. The apparatus is further configured to, for each of the elements of the hierarchy: save the input keyword string, apply a logical "AND" operation to the bit vector of the element and a bit vector based at least in part on the input keyword string, the applying producing a result. The apparatus (FIG. 2, reference numeral 204) is further configured to, if the result is nonzero, remove from the input keyword string any words in the input keyword string that are prefixes of words in the element. The apparatus (FIG. 2, reference numeral 204) is further configured to, if the input keyword string is empty, add the element to a list of matched items, restore the input keyword string, and render the list of matched items. The apparatus (FIG. 2, reference numeral 204) is further configured to apply a conventional keyword

matching algorithm to the at least one keyword string represented by one or more element in the list of matched items.

Claim 197 is directed to a method for comparing keyword strings on a wireless user device. The method includes assigning each of at least one symbol in a language to one of a plurality of groups. (FIG. 12, reference numeral 1210; ¶[0042], ll. 7-10). The method also includes comparing a first keyword string and a second keyword string based at least in part on whether at least one symbol of the first keyword string is assigned to the same group as at least one corresponding symbol of the second keyword string. (FIG. 12, reference numeral 1215; ¶[0042], ll. 10-12).

Claim 199 is directed to a method for comparing keyword strings on a wireless user device. The method includes a step for assigning each of at least one symbol in a language to one of a plurality of groups. (FIG. 12, reference numeral 1210; ¶[0042], ll. 7-10). The method also includes a step for comparing a first keyword string and a second keyword string based at least in part on whether at least one symbol of the first keyword string is assigned to the same group as at least one corresponding symbol of the second keyword string. (FIG. 12, reference numeral 1215; ¶[0042], ll. 10-12).

Claim 201 is directed to a program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for comparing keyword strings on a wireless user device. The method includes assigning each of at least one symbol in a language to one of a plurality of groups. (FIG. 12, reference numeral 1210; ¶[0042], ll. 7-10).

The method also includes comparing a first keyword string and a second keyword string based at least in part on whether at least one symbol of the first keyword string is assigned to the same group as at least one corresponding symbol of the second keyword string. (FIG. 12, reference numeral 1215; ¶[0042], ll. 10-12).

Claim 203 is directed to an apparatus for comparing keyword strings on a wireless user device. The apparatus includes means (¶[0011]-[0012]; processor 104) for assigning each of at least one symbol in a language to one of a plurality of groups. (FIG. 12, reference numeral 1210; ¶[0042], ll. 7-10). The apparatus also includes means (¶[0011]-[0012]; search engine 204) for comparing a first keyword string and a second keyword string based at least in part on whether at least one symbol of the first keyword string is assigned to the same group as at least one corresponding symbol of the second keyword string. (FIG. 12, reference numeral 1215; ¶[0042], ll. 10-12).

Claim 205 is directed to an apparatus for comparing keyword strings on a wireless user device. The apparatus includes a memory for storing the keyword strings. The apparatus also includes a processor (FIG. 1, reference numeral 104) configured to: assign each of at least one symbol in a language to one of a plurality of groups. The processor (FIG. 1, reference numeral 104) is further configured to compare a first keyword string and a second keyword string based at least in part on whether at least one symbol of the first keyword string is assigned to the same group as at least one corresponding symbol of the second keyword string.

**Grounds of Rejection to be Reviewed on Appeal**

Whether Claims 1, 2, 13, 16-18, 21, 24-28, 32, 35-37, 40, 43, 45, 46, 57, 60-62, 65, 68-72, 76, 79-81, 84, 87, 89, 90, 101, 104-106, 109, 112-116, 120, 123-125, 128, 131, 133, 134, 142, 145-147, 150-155, 158-160, 163, 165, 166, 174, 177-179, 182, 182-187, 190-192, and 195 are unpatentable under 35 U.S.C. § 103(a) over U.S. Patent No. 5,774,588 (Li; hereinafter, "Li") in view of U.S. Publication No. 2004/0097246 (Welch; hereinafter, "Welch").

Whether Claims 3-9, 47-53, 91-97, 135-141, and 167-173 are patentable under 35 U.S.C. § 103(a) over Li in view of Welch and further in view of U.S. Publication No. 2004/0064787 (Braun et al.; hereinafter, "Braun et al.").

Whether Claims 14-15, 19-20, 22-23, 33-34, 38-39, 41-42, 58-59, 63-64, 66-67, 77-78, 82-83, 85-86, 102-103, 107-108, 110-111, 121-122, 126-127, 129-130, 143-144, 148-149, 156-157, 161-162, 175-176, 180-181, 188-189, and 193-194 are patentable under 35 U.S.C. § 103(a) over Li in view of Welch and further in view of U.S. Publication No. 2004/0260929 (Albornoz et al.; hereinafter, "Albornoz et al.").

Whether Claims 44, 88, 132, 164, and 196 are patentable under 35 U.S.C. § 103(a) over Li in view of Welch and further in view of U.S. Patent No. 6,499,033 (Vagnozzi; hereinafter, "Vagnozzi").

Whether Claims 197- 206 are patentable under 35 U.S.C. § 103(a) over Li in view of U.S. Patent No. 6,496,836 (Ronchi et al.; hereinafter, "Ronchi et al.").

### Argument

Rejection of Claims 1, 2, 13, 16-18, 21, 24-28, 32, 35-37, 40, 43, 45, 46, 57, 60-62, 65, 68-72, 76, 79-81, 84, 87, 89, 90, 101, 104-106, 109, 112-116, 120, 123-125, 128, 131, 133, 134, 142, 145-147, 150-155, 158-160, 163, 165, 166, 174, 177-179, 182, 182-187, 190-192, and 195 under 35 U.S.C. § 103(a)

#### Independent Claims 1, 45, 89, 133, and 165

Independent Claims 1, 45, 89, 133, and 165 recite, *inter alia*, for *each* of said one or more candidate keyword strings, creating a *single* bit vector based at least in part on said each of said one or more candidate keyword strings, said bit vector for use in comparing an input bit vector with said bit vector to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings, said input keyword string provided by a user of said wireless user device. (emphasis added) These features are not disclosed in either Li, or Welch, even if, *arguendo*, these references were properly combinable. These features are also not suggested by Li and Welch, considered singularly or in combination.

The Examiner contends these features are disclosed by Li. However, as indicated by the Examiner, Li discloses partitioning a signature vector into *seven* groups of 12 bits each, translating each of the seven 12-bit binary numbers into decimal numbers which are used to create a bucket address table. And rather than storing the one or more bit vectors as required by Claims 1, 45, 89, 133, and 165, Li discloses storing pointers to lexicon entries in the bucket address table. The Applicant respectfully submits it is improper to equate storing a single bit vector that is based at least in part on a candidate keyword string, with storing pointers to lexicon entries in a bucket address table as proposed by the Examiner.

Accordingly, a *prima facie* case of obviousness has not been established, and the rejection of claims 1, 45, 89, 133, and 165, and the claims dependent therefrom, based on the combination of Li and Welch, is improper.

Independent Claims 13, 57, 101, 142, and 174

Independent claims 13, 57, 101, 142, and 174 recite, *inter alia*, creating a *single* bit vector based at least in part on said input keyword string. (emphasis added) Thus, the arguments made with respect to independent Claims 1, 45, 89, 133, and 165 apply here as well. Claims 1, 45, 89, 133, and 165 being allowable, Claims 13, 57, 101, 142, and 174 must also be allowable.

Accordingly, a *prima facie* case of obviousness has not been established, and the rejection of claims 13, 57, 101, 142, and 174, and the claims dependent therefrom, based on the combination of Li and Welch, is improper.

Independent Claims 17, 61, 105, 146, and 178

Independent claims 17, 61, 105, 146, and 178 recite, *inter alia*, for *each* of said one or more candidate keyword strings, creating a *single* bit vector based at least in part on said each of said one or more candidate keyword strings, said bit vector for use in comparing an input bit vector with said bit vector to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings, said input keyword string provided by a user of said wireless user device. (emphasis added) Thus, the arguments made with respect to independent Claims 1, 45, 89, 133, and 165 apply here as well. Claims 1, 45, 89, 133, and 165 being allowable, Claims 17, 61, 105, 146, and 178 must also be allowable.

Accordingly, a *prima facie* case of obviousness has not been established, and the rejection of claims 17, 61, 105, 146, and 178 based on the combination of Li and Welch is improper.

Independent Claims 18, 62, and 106

Independent Claims 18, 62, and 106 recite, *inter alia*, receiving in response to said submitting at least one candidate keyword string where the first symbol of at least one word in each of said at least one candidate keyword string matches the first symbol of the corresponding word in said input keyword string. These features are not disclosed in either Li, or Welch, even if, *arguendo*, these references were properly combinable. These features are also not suggested by Li and Welch, considered singularly or in combination.

Accordingly, a *prima facie* case of obviousness has not been established, and the rejection of claims 18, 62, and 106, and the claims dependent therefrom, based on the combination of Li and Welch, is improper.

Independent Claims 21, 65, 109, 145, and 179

Independent claims 21, 65, 109, 145, and 179 recite, *inter alia*, creating a *single* bit vector based at least in part on said input keyword string. (emphasis added) Thus, the arguments made with respect to Claims 1, 45, 89, 133, and 165 apply here as well. Claims 1, 45, 89, 133, and 165 being allowable, Claims 21, 65, 109, 145, and 179 must also be allowable.



Accordingly, a *prima facie* case of obviousness has not been established, and the rejection of claims 21, 65, 109, 145, and 179, and the claims dependent therefrom, based on the combination of Li and Welch, is improper.

Independent Claims 25, 69, 113, 151, and 183

Independent Claims 25, 69, 113, 151, and 183 recite, *inter alia*, determining a relative frequency of use for at least one symbol in a language. These features are not disclosed in either Li or Welch, even if, *arguendo*, these references were properly combinable. These features are also not suggested by Li and Welch, considered singularly or in combination.

The Examiner contends these features are disclosed by Li. The Applicant respectfully disagrees. In support of the Examiner's contention, the Examiner refers to portions of Li that disclose accumulating a counter for each of 85 bits in a signature vector based on the presence of particular bi-grams in lexicon strings. A bi-gram vector based on the English language alphabet would have bits representing the character *combinations* AA, AB, AC, AD . . . ZW, ZX, ZY, ZZ, for a total of 676 entries.<sup>1</sup> The Applicant respectfully submits that the Examiner's attempt to equate a symbol in Claims 25, 69, 113, 151, and 183 with a bi-gram disclosed by Li is improper, as the bi-gram of Li is a *combination* of characters. Thus, Li discloses determining the frequency of a combination of characters; Li does not disclose determining a relative frequency of use for at least one *symbol* in a language. For this reason, the 35 U.S.C. § 103(a) rejection of Claims 25, 69, 113, 151, and 183 based on Li in view of Welch is unsupported by the art.

---

<sup>1</sup> Li at col. 2 ll. 3-6.

Additionally, since Li does not disclose determining a relative frequency of use for at least one symbol in a language, Li cannot teach assigning a statistical weighting to said at least one symbol based at least in part on a relative frequency of use of said at least one symbol as required by Claims 25, 69, 113, 151, and 183. For this additional reason, the 35 U.S.C. § 103(a) rejection of Claims 25, 69, 113, 151, and 183 based on Li in view of Welch is unsupported by the art.

And since Li discloses analysis based on *bi-grams*, Li cannot be said to disclose assigning each of said at least one *symbol* to one of a plurality of groups. For this additional reason, the 35 U.S.C. § 103(a) rejection of Claims 25, 69, 113, 151, and 183 based on Li in view of Welch is unsupported by the art.

Accordingly, a *prima facie* case of obviousness has not been established, and the rejection of claims 25, 69, 113, 151, and 183, and the claims dependent therefrom, based on the combination of Li and Welch, is improper.

Independent Claims 28, 72, 116, 154, and 186

Independent claims 28, 72, 116, 154, and 186 recite, *inter alia*, creating one or more bit vectors based at least in part on said one or more candidate keyword strings, each bit of said one or more bit vectors corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to the first symbol of a word in said one or more candidate keyword strings being set, said one or more bit vectors for use in comparing an input bit vector with said one or more bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings. Thus, the arguments made with

respect to independent Claims 1, 45, 89, 133, and 165 apply here as well. Claims 1, 45, 89, 133, and 165 being allowable, Claims 28, 72, 116, 154, and 186 must also be allowable.

Accordingly, a *prima facie* case of obviousness has not been established, and the rejection of claims 28, 72, 116, 154, and 186, and the claims dependent therefrom, based on the combination of Li and Welch, is improper.

Independent Claims 32, 33, 76, 120, 159, and 191

Independent Claims 32, 33, 76, 120, 159, and 191 recite in part creating a *single* bit vector based at least in part on said input keyword string. (emphasis added) Thus, the arguments made with respect to Claims 1, 45, 89, 133, and 165 apply here as well. Claim 1, 45, 89, 133, and 165 being allowable, Claims 32, 33, 76, 120, 159, and 191 must also be allowable.

Accordingly, a *prima facie* case of obviousness has not been established, and the rejection of claims 32, 33, 76, 120, 159, and 191 based on the combination of Li and Welch, is improper.

Independent Claims 36, 80, 124, 159, and 191

Independent Claims 36, 80, 124, 159, and 191 recite in part creating one or more bit vectors based at least in part on said one or more candidate keyword strings, each bit of said one or bit vector corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to a symbol of a prefix of a word in said one or more candidate keyword strings being set, said one or more bit vectors for use in comparing an input bit vector with said one or

more bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings. Thus, the arguments made with respect to Claims 1, 45, 89, 133, and 165 apply here as well. Claim 1, 45, 89, 133, and 165 being allowable, Claims 36, 80, 124, 159, and 191 must also be allowable.

Accordingly, a *prima facie* case of obviousness has not been established, and the rejection of claims 36, 80, 124, 159, and 191 based on the combination of Li and Welch, is improper.

Independent Claims 37, 81, and 125

Independent Claims 37, 81, and 125 recite, *inter alia*, receiving in response to said submitting at least one candidate keyword string where a prefix of a word of a matching candidate keyword string comprises at least one symbol that belongs to the same symbol group as the corresponding symbol of the corresponding word in said input keyword string. Thus, the arguments made with respect to Claims 18, 62, and 106 apply here as well. Claims 18, 62, and 106 being allowable, Claims 37, 81, and 125 must also be allowable.

Accordingly, a *prima facie* case of obviousness has not been established, and the rejection of claims 37, 81, and 125 based on the combination of Li and Welch is improper.

Independent Claims 40, 84, and 128

Independent claims 40, 84, and 128 recite, *inter alia*, creating a *single* bit vector based at least in part on said input keyword string. (emphasis added) Thus, the arguments made with

respect to independent Claims 1, 45, 89, 133, and 165 apply here as well. Claims 1, 45, 89, 133, and 165 being allowable, Claims 40, 84, and 128 must also be allowable.

Accordingly, a *prima facie* case of obviousness has not been established, and the rejection of claims 40, 84, and 128, and the claims dependent therefrom, based on the combination of Li and Welch, is improper.

Rejection of Claims 3-9, 47-53, 91-97, 135-141, and 167-173 under 35 U.S.C. § 103(a)

Claims 3-9, 47-53, 91-97, 135-141, and 167-173 depend directly or indirectly from base claims 1, 45, 89, 133, and 165, respectively. Welch fails to remedy the above-mentioned shortcomings of Li with respect to claims 1, 45, 89, 133, and 165. Accordingly, claims 3-9, 47-53, 91-97, 135-141, and 167-173, which by definition include the limitations of claims 1, 45, 89, 133, and 165, respectively, are patentable over the combination of these references.

Rejection of Claims 14-15, 19-20, 22-23, 33-34, 38-39, 41-42, 58-59, 63-64, 66-67, 77-78, 82-83, 85-86, 102-103, 107-108, 110-111, 121-122, 126-127, 129-130, 143-144, 148-149, 156-157, 161-162, 175-176, 180-181, 188-189, and 193-194 under 35 U.S.C. § 103(a)

Claims 14-15, 19-20, 22-23, 33-34, 38-39, 41-42, 58-59, 63-64, 66-67, 74-75, 77-78, 82-83, 85-86, 102-103, 107-108, 110-111, 121-122, 126-127, 129-130, 143-144, 148-149, 156-157, 161-162, 175-176, 180-181, 188-189, and 193-194 depend directly or indirectly from base claims 13, 18, 21, 32, 37, 40, 57, 62, 65, 76, 81, 84, 101, 106, 109, 120, 125, 128, 142, 147, 155, 160, 174, 179, 187, and 192, respectively. Welch fails to remedy the above-mentioned shortcomings of Li with respect to claims 13, 18, 21, 32, 37, 40, 57, 62, 65, 76, 81, 84, 101, 106, 109, 120, 125, 128, 142, 147, 155, 160, 174, 179, 187, and 192. Accordingly, claims 14-15, 19-

20, 22-23, 33-34, 38-39, 41-42, 58-59, 63-64, 66-67, 74-75, 77-78, 82-83, 85-86, 102-103, 107-108, 110-111, 121-122, 126-127, 129-130, 143-144, 148-149, 156-157, 161-162, 175-176, 180-181, 188-189, and 193-194, which by definition include the limitations of claims 13, 18, 21, 32, 37, 40, 57, 62, 65, 76, 81, 84, 101, 106, 109, 120, 125, 128, 142, 147, 155, 160, 174, 179, 187, and 192, respectively, are patentable over the combination of these references.

Rejection of Claims 44, 88, 132, 164, and 196 are patentable under 35 U.S.C. § 103(a)

Independent Claims 44, 88, 132, 164, and 196 recite, *inter alia*, receiving from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string. These features are not disclosed in either Li, Welch, or Vagonzzi, even if, *arguendo*, these references were properly combinable. These features are also not suggested by Li, Welch, or Vagonzzi, considered singularly or in combination. The arguments made above with respect to independent Claims 32, 76, 120, 155, and 187 apply here as well.

Independent Claims 44, 88, 132, 164, and 196 also recite, *inter alia*, said searching comprising, for *each* of said elements of said hierarchy ... saving said input keyword string. (emphasis added). These features are not disclosed in either Li, Welch, or Vagonzzi, even if, *arguendo*, these references were properly combinable. These features are also not suggested by Li, Welch, or Vagonzzi, considered singularly or in combination. In support of the Examiner's contention, the Examiner refers to the following portion of Vagonzzi:

Query processing is implemented by computer 52 by way of microprocessor 54 executing instructions from database management program 64. Program 64 locates the one or more records that satisfies a particular user query by creating a

target keys (e.g., c:0:blue) for each coarse and fine slice and then searches the appropriate index for those target keys, starting with the lowest key valued key (i.e., coarse slice 0). If no key is found, a bit vector of all zeros is returned. If a matching key is found in the index, then the associated link is used to obtain a bit vector for that key. If the link is of type 0, as shown in FIGS. 8 and 9, then the bit vector identified by the link is returned. Where one or both of the keys' links are of type 1; that is, they contain a relative fine slice number (in the case of a coarse key) or a relative record number (in the case of a fine key) rather than a pointer to a bit vector, then a bit vector is created and, for a fine bit vector, the bit corresponding to the record identified by the link is set to one and the remaining bits of the vector being cleared to zero. When creating a coarse bit vector (which includes both ANY bits and ALL bits), the ANY bit corresponding to the fine slice number identified by the link is set to one, with the remaining ANY bits being cleared to zero, and the ALL bit corresponding to the fine slice number identified by the link is set to the same value (0 or 1) as the ALL bit contained in the link, with the other ALL bits being cleared to zero. In this way, query processing can always be carried out using bit vectors, regardless of which type of link is stored in the index.<sup>2</sup>

Nowhere does the cited portion of Vagonzzi disclose for each of said elements of a hierarchy, saving an input keyword string.

Independent Claims 44, 88, 132, 164, and 196 also recite, *inter alia*, said searching comprising, for *each* of said elements of said hierarchy ... applying a logical “AND” operation to the bit vector of the element and a bit vector based at least in part on said input keyword string. These features are not disclosed in either Li, Welch, or Vagonzzi, even if, *arguendo*, these references were properly combinable. These features are also not suggested by Li, Welch, or Vagonzzi, considered singularly or in combination. Nowhere does the cited portion of Vagonzzi disclose for each of said elements of a hierarchy, applying a logical “AND” operation to the bit vector of the element and a bit vector based at least in part on an input keyword string.

---

<sup>2</sup> Vagonzzi at col. 11 ll. 1-27.

Independent Claims 44, 88, 132, 164, and 196 also recite, *inter alia*, said searching comprising, for *each* of said elements of said hierarchy ... if said result is nonzero, removing from said input keyword string any words in said input keyword string that are prefixes of words in the element. These features are not disclosed in either Li, Welch, or Vagonzzi, even if, *arguendo*, these references were properly combinable. These features are also not suggested by Li, Welch, or Vagonzzi, considered singularly or in combination. Nowhere does the cited portion of Vagonzzi disclose for each of said elements of a hierarchy, if a search result is nonzero, removing from an input keyword string any words in the input keyword string that are prefixes of words in an element.

Claims 44, 88, 132, 164, and 196 also recite, *inter alia*, said searching comprising, for *each* of said elements of said hierarchy ... if said input keyword string is empty, adding said element to a list of matched items. These features are not disclosed in either Li, Welch, or Vagonzzi, even if, *arguendo*, these references were properly combinable. These features are also not suggested by Li, Welch, or Vagonzzi, considered singularly or in combination. Nowhere does the cited portion of Vagonzzi disclose for each of said elements of a hierarchy, if an input keyword string is empty, adding the element to a list of matched items.

Claims 44, 88, 132, 164, and 196 also recite, *inter alia*, said searching comprising, for *each* of said elements of said hierarchy ... restoring said input keyword string. These features are not disclosed in either Li, Welch, or Vagonzzi, even if, *arguendo*, these references were properly combinable. These features are also not suggested by Li, Welch, or Vagonzzi,



considered singularly or in combination. Nowhere does the cited portion of Vagonzzi disclose for each of said elements of a hierarchy, restoring an input keyword string.

Accordingly, a *prima facie* case of obviousness has not been established, and the rejection of claims 44, 88, 132, 164, and 196, based on the combination of Li, Welch and Vagonzzi, is improper.

Rejection of Claims 197-206 under 35 U.S.C. § 103(a)

Independent Claims 197, 199, 203, and 205 recite, *inter alia*, assigning each of at least one symbol in a language to one of a plurality of groups. Independent Claims 197, 199, 203, and 205 also recite, *inter alia* comparing a first keyword string and a second keyword string based at least in part on whether at least one symbol of said first keyword string is assigned to the same group as at least one corresponding symbol of said second keyword string. These features are not disclosed in either Li, or Ronchi et al., even if, *arguendo*, these references were properly combinable. These features are also not suggested by Li or Ronchi et al., considered singularly or in combination. The arguments made above with respect to independent Claims 25, 69, 113, 151, and 183 apply here as well, as the recited limitations are also found in Claims 25, 69, 113, 151, and 183.

Accordingly, a *prima facie* case of obviousness has not been established, and the rejection of claims 197, 199, 203, and 205, and the claims dependent therefrom, based on the combination of Li and Ronchi et al., is improper.

**Claims Appendix**

1. A method for creating a keyword string database on a wireless user device, the method comprising:  
  
determining one or more candidate keyword strings to store in said database;  
  
for each of said one or more candidate keyword strings, creating a single bit vector based at least in part on said each of said one or more candidate keyword strings, said bit vectors for use in comparing an input bit vector with said bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings, said input keyword string provided by a user of said wireless user device; and  
  
storing said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.
2. The method of claim 1 wherein said bit vector further comprises at least one bit that represents a non-alphanumeric symbol.
3. The method of claim 2 wherein said non-alphanumeric symbol indicates an email address.
4. The method of claim 2 wherein said non-alphanumeric symbol indicates a mobile number.
5. The method of claim 2 wherein said non-alphanumeric symbol indicates a wired number.

6. The method of claim 2 wherein said non-alphanumeric symbol indicates a paper-mail address.
7. The method of claim 2 wherein said non-alphanumeric symbol indicates a cost ranking.
8. The method of claim 2 wherein said non-alphanumeric symbol indicates a quality ranking.
9. The method of claim 2 wherein said non-alphanumeric symbol indicates a cuisine.
- 10-12. (Cancelled)
13. A method for incremental keyword search on a wireless user device, the method comprising:
  - receiving from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols;
  - creating a single bit vector based at least in part on said input keyword string;
  - comparing said bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors;
  - applying a conventional keyword matching algorithm to said at least one candidate keyword string represented by said set of matching bit vectors; and
  - presenting any matching candidate keyword strings.
14. The method of claim 13, further comprising preempting said method after a predetermined amount of time.

15. The method of claim 14 wherein said predetermined amount of time is two seconds.
16. The method of claim 13 wherein said comparing is independent of the order of keyword prefixes in keyword strings.
17. A method for creating a keyword string database on a wireless user device, the method comprising:  
determining one or more candidate keyword strings to store in said database;  
for each of said one or more candidate keyword strings, creating a single bit vector based at least in part on said each of said one or more candidate keyword strings, said bit vector having a bit position for each symbol in an alphabet and having bits set for bit positions corresponding to at least one symbol representing the first symbol of a word in said each of said one or more candidate keyword strings, said bit vectors for use in comparing an input bit vector with said bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings; and  
storing said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.
18. A method for incremental keyword search on a wireless user device, the method comprising:  
submitting to said wireless user device an input keyword string comprising one or more words comprising one or more symbols; and

receiving in response to said submitting at least one candidate keyword string where the first symbol of at least one word in each of said at least one candidate keyword string matches the first symbol of the corresponding word in said input keyword string.

19. The method of claim 18, further comprising preempting said method after a predetermined amount of time.
20. The method of claim 19 wherein said predetermined amount of time is two seconds.
21. A method for incremental keyword search on a wireless user device, the method comprising:
  - receiving from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols;
  - creating a single bit vector based at least in part on said input keyword string, said bit vector having a bit position for each symbol in an alphabet and having bits set for positions corresponding to at least one symbol representing the first symbol of a word in said input keyword string;
  - comparing said bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors;
  - applying a conventional keyword matching algorithm to said at least one candidate keyword string represented by said set of matching bit vectors; and
  - presenting any matching candidate keyword strings.

22. The method of claim 21, further comprising preempting said method after a predetermined amount of time.
23. The method of claim 22 wherein said predetermined amount of time is two seconds.
24. The method of claim 21 wherein said comparing is independent of the order of keyword prefixes in keyword strings.
25. A method for comparing keyword strings on a wireless user device, the method comprising:  
determining a relative frequency of use for at least one symbol in a language;  
assigning a statistical weighting to said at least one symbol based at least in part on a relative frequency of use of said at least one symbol;  
assigning each of said at least one symbol to one of a plurality of groups;  
comparing a first keyword string and a second keyword string based at least in part on whether at least one symbol of said first keyword string is assigned to the same group as at least one corresponding symbol of said second keyword string; and  
presenting a result of said comparing to a user of said wireless user device.
26. The method of claim 25 wherein said assigning further comprises assigning each of said at least one symbol to one of a plurality of groups so as to minimize the difference between the sums of statistical weightings for symbols comprising each group in said plurality of groups.

27. The method of claim 25 wherein said relative frequency of use comprises the relative frequency of use of symbols in the first character of words in said language.
28. A method for creating a keyword string database on a wireless user device, the method comprising:  
determining one or more candidate keyword strings to store in said database;  
creating one or more bit vectors based at least in part on said one or more candidate keyword strings, each bit of said one or more bit vectors corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to the first symbol of a word in said one or more candidate keyword strings being set, said one or more bit vectors for use in comparing an input bit vector with said one or more bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings; and  
storing said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.
- 29-31. (Cancelled)
32. A method for incremental keyword search on a wireless user device, the method comprising:  
receiving from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string;

creating a single bit vector based at least in part on said input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to said one or more symbols being set;

comparing said bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors;

applying a conventional keyword matching algorithm to said at least one candidate keyword string represented by said set of matching bit vectors; and

presenting any matching candidate keyword strings.

33. The method of claim 32, further comprising preempting said method after a predetermined amount of time.

34. The method of claim 33 wherein said predetermined amount of time is two seconds.

35. The method of claim 32 wherein said comparing is independent of the order of keyword prefixes in keyword strings.

36. A method for creating a keyword string database on a wireless user device, the method comprising:

determining one or more candidate keyword strings to store in said database;

creating one or more bit vectors based at least in part on said one or more candidate keyword strings, each bit of said one or bit vector corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to a symbol of a prefix of a word in



said one or more candidate keyword strings being set, said one or more bit vectors for use in comparing an input bit vector with said one or more bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings; and  
storing said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.

37. A method for incremental keyword search on a wireless user device, the method comprising:  
submitting an input keyword string comprising one or more words comprising one or more symbols; and  
receiving in response to said submitting at least one candidate keyword string where a prefix of a word of a matching candidate keyword string comprises at least one symbol that belongs to the same symbol group as the corresponding symbol of the corresponding word in said input keyword string.
38. The method of claim 37, further comprising preempting said method after a predetermined amount of time.
39. The method of claim 38 wherein said predetermined amount of time is two seconds.
40. A method for incremental keyword search on a wireless user device, the method comprising:  
receiving from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols;

creating a single bit vector based at least in part on said input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to a prefix of a word in said one or more symbols being set;  
comparing said bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors;  
applying a conventional keyword matching algorithm to said at least one candidate keyword string represented by said set of matching bit vectors; and  
presenting any matching candidate keyword strings.

41. The method of claim 40, further comprising preempting said method after a predetermined amount of time.

42. The method of claim 41 wherein said predetermined amount of time is two seconds.

43. The method of claim 40 wherein said comparing is independent of the order of keyword prefixes in keyword strings.

44. A method for incremental keyword search on a wireless user device, the method comprising:  
receiving from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string;

receiving a hierarchy, elements of said hierarchy comprising intermediate nodes and leaf nodes representing one or more keyword strings comprising one or more words comprising one or more symbols;

creating hierarchy bit vectors corresponding to said one or more keyword strings in said hierarchy;

searching said hierarchy bit vectors for a match with said input keyword string, said searching comprising, for each of said elements of said hierarchy:

saving said input keyword string;

applying a logical “AND” operation to the bit vector of the element and a bit vector based at least in part on said input keyword string, said applying producing a result;

if said result is nonzero, removing from said input keyword string any words in said input keyword string that are prefixes of words in the element;

if said input keyword string is empty, adding said element to a list of matched items; and

restoring said input keyword string; and

rendering said list of matched items.

45. A method for creating a keyword string database on a wireless user device, the method comprising:

step for determining one or more candidate keyword strings to store in said database;

step for, for each of said one or more candidate keyword strings, creating a single bit vector based at least in part on said each of said one or more candidate keyword strings, said bit vector for use in comparing an input bit vector with said bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one

- or more candidate keyword strings, said input keyword string provided by a user of said wireless user device; and
- step for storing said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.
46. The method of claim 45 wherein said bit vector further comprises at least one bit that represents a non-alphanumeric symbol.
47. The method of claim 46 wherein said non-alphanumeric symbol indicates an email address.
48. The method of claim 46 wherein said non-alphanumeric symbol indicates a mobile number.
49. The method of claim 46 wherein said non-alphanumeric symbol indicates a wired number.
50. The method of claim 46 wherein said non-alphanumeric symbol indicates a paper-mail address.
51. The method of claim 46 wherein said non-alphanumeric symbol indicates a cost ranking.
52. The method of claim 46 wherein said non-alphanumeric symbol indicates a quality ranking.
53. The method of claim 46 wherein said non-alphanumeric symbol indicates a cuisine.

54-56. (Cancelled)

57. A method for incremental keyword search on a wireless user device, the method comprising:

step for receiving from a user of said wireless user device an input keyword string

comprising one or more words comprising one or more symbols;

step for creating a single bit vector based at least in part on said input keyword string;

step for comparing said bit vector with one or more other bit vectors representing at least

one candidate keyword string to create a set of matching bit vectors;

step for applying a conventional keyword matching algorithm to said at least one candidate

keyword string represented by said set of matching bit vectors; and

step for presenting any matching candidate keyword strings.

58. The method of claim 57, further comprising step for preempting said method after a predetermined amount of time.

59. The method of claim 58 wherein said predetermined amount of time is two seconds.

60. The method of claim 57 wherein said comparing is independent of the order of keyword prefixes in keyword strings.

61. A method for creating a keyword string database on a wireless user device, the method comprising:

step for determining one or more candidate keyword strings to store in said database;

step for, for each of said one or more candidate keyword strings, creating a single bit vector based at least in part on said each of said one or more candidate keyword strings, said bit vector having a bit position for each symbol in an alphabet and having bits set for bit positions corresponding to at least one symbol representing the first symbol of a word in said each of said one or more candidate keyword strings, said bit vectors for use in comparing an input bit vector with said bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings; and

step for storing said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.

62. A method for incremental keyword search on a wireless user device, the method comprising:

step for submitting to said wireless user device an input keyword string comprising one or more words comprising one or more symbols; and

step for receiving in response to said submitting at least one candidate keyword string where the first symbol of at least one word in each of said at least one candidate keyword string matches the first symbol of the corresponding word in said input keyword string.

63. The method of claim 62, further comprising step for preempting said method after a predetermined amount of time.

64. The method of claim 63 wherein said predetermined amount of time is two seconds.

65. A method for incremental keyword search on a wireless user device, the method comprising:
- step for receiving from a user of said wireless user device an input keyword string
    - comprising one or more words comprising one or more symbols;
  - step for creating a single bit vector based at least in part on said input keyword string, said bit vector having a bit position for each symbol in an alphabet and having bits set for positions corresponding to at least one symbol representing the first symbol of a word in said input keyword string;
  - step for comparing said bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors;
  - step for applying a conventional keyword matching algorithm to said at least one candidate keyword string represented by said set of matching bit vectors; and
  - step for presenting any matching candidate keyword strings.
66. The method of claim 65, further comprising step for preempting said method after a predetermined amount of time.
67. The method of claim 66 wherein said predetermined amount of time is two seconds.
68. The method of claim 65 wherein said comparing is independent of the order of keyword prefixes in keyword strings.
69. A method for comparing keyword strings on a wireless user device, the method comprising:
- step for determining a relative frequency of use for at least one symbol in a language;

step for assigning a statistical weighting to said at least one symbol based at least in part on a relative frequency of use of said at least one symbol;  
step for assigning each of said at least one symbol to one of a plurality of groups; and  
step for comparing a first keyword string and a second keyword string based at least in part on whether at least one symbol of said first keyword string is assigned to the same group as at least one corresponding symbol of said second keyword string; and  
step for presenting a result of said comparing to a user of said wireless user device.

70. The method of claim 69 wherein said step for assigning further comprises step for assigning each of said at least one symbol to one of a plurality of groups so as to minimize the difference between the sums of statistical weightings for symbols comprising each group in said plurality of groups.

71. The method of claim 69 wherein said relative frequency of use comprises the relative frequency of use of symbols in the first character of words in said language.

72. A method for creating a keyword string database on a wireless user device, the method comprising:  
step for determining one or more candidate keyword strings to store in said database;  
step for creating one or more bit vectors based at least in part on said one or more candidate keyword strings, each bit of said one or more bit vectors corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to the first symbol of a word in said one or more candidate keyword strings being set, said one or more bit



vectors for use in comparing an input bit vector with said one or more bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings; and  
step for storing said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.

73-75. (Cancelled)

76. A method for incremental keyword search on a wireless user device, the method comprising:  
step for receiving from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string;  
step for creating a single bit vector based at least in part on said input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to said one or more symbols being set;  
step for comparing said bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors;  
step for applying a conventional keyword matching algorithm to said at least one candidate keyword string represented by said set of matching bit vectors; and  
step for presenting any matching candidate keyword strings.

77. The method of claim 76, further comprising step for preempting said method after a predetermined amount of time.

78. The method of claim 77 wherein said predetermined amount of time is two seconds.
79. The method of claim 76 wherein said comparing is independent of the order of keyword prefixes in keyword strings.
80. A method for creating a keyword string database on a wireless user device, the method comprising:  
step for determining one or more candidate keyword strings to store in said database;  
step for creating one or more bit vectors based at least in part on said one or more candidate keyword strings, each bit of said one or more bit vector corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to a symbol of a prefix of a word in said one or more candidate keyword strings being set, said one or more bit vectors for use in comparing an input bit vector with said one or more bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings; and  
step for storing said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.
81. A method for incremental keyword search on a wireless user device, the method comprising:  
step for submitting an input keyword string comprising one or more words comprising one or more symbols; and  
step for receiving in response to said submitting at least one candidate keyword string where a prefix of a word of a matching candidate keyword string comprises at least one symbol

that belongs to the same symbol group as the corresponding symbol of the corresponding word in said input keyword string.

82. The method of claim 81, further comprising step for preempting said method after a predetermined amount of time.

83. The method of claim 82 wherein said predetermined amount of time is two seconds.

84. A method for incremental keyword search on a wireless user device, the method comprising:  
step for receiving from a user of said wireless user device an input keyword string  
comprising one or more words comprising one or more symbols;  
step for creating a single bit vector based at least in part on said input keyword string, each  
bit corresponding to one or more symbols in an alphabet, bits having a bit position  
corresponding to a prefix of a word in said one or more symbols being set;  
step for comparing said bit vector with one or more other bit vectors representing at least  
one candidate keyword string to create a set of matching bit vectors;  
step for applying a conventional keyword matching algorithm to said at least one candidate  
keyword string represented by said set of matching bit vectors; and  
step for presenting any matching candidate keyword strings.

85. The method of claim 84, further comprising step for preempting said method after a predetermined amount of time.

86. The method of claim 85 wherein said predetermined amount of time is two seconds.
87. The method of claim 84 wherein aid comparing is independent of the order of keyword prefixes in keyword strings.
88. A method for incremental keyword search on a wireless user device, the method comprising:
- step for receiving from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string;
  - step for receiving a hierarchy, elements of said hierarchy comprising intermediate nodes and leaf nodes representing one or more keyword strings comprising one or more words comprising one or more symbols;
  - step for creating hierarchy bit vectors corresponding to said one or more keyword strings in said hierarchy;
  - step for searching said hierarchy bit vectors for a match with said input keyword string, said step for searching comprising, for each of said elements of said hierarchy:
  - step for saving said input keyword string;
  - step for applying a logical “AND” operation to the bit vector of the element and a bit vector based at least in part on said input keyword string, said applying producing a result;
  - step for if said result is nonzero, removing from said input keyword string any words in said input keyword string that are prefixes of words in the element;
  - step for if said input keyword string is empty, adding said element to a list of matched items;
  - and

step for restoring said input keyword string; and  
step for rendering said list of matched items.

89. A program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for creating a keyword string database on a wireless user device, the method comprising:  
determining one or more candidate keyword strings to store in said database;  
for each of said one or more candidate keyword strings, creating a single bit vector based at least in part on said each of said one or more candidate keyword strings, said bit vectors for use in comparing an input bit vector with said bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings, said input keyword string provided by a user of said wireless user device; and  
storing said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.
90. The program storage device of claim 89 wherein said bit vector further comprises at least one bit that represents a non-alphanumeric symbol.
91. The program storage device of claim 90 wherein said non-alphanumeric symbol indicates an email address.

92. The program storage device of claim 90 wherein said non-alphanumeric symbol indicates a mobile number.
93. The program storage device of claim 90 wherein said non-alphanumeric symbol indicates a wired number.
94. The program storage device of claim 90 wherein said non-alphanumeric symbol indicates a paper-mail address.
95. The program storage device of claim 90 wherein said non-alphanumeric symbol indicates a cost ranking.
96. The program storage device of claim 90 wherein said non-alphanumeric symbol indicates a quality ranking.
97. The program storage device of claim 90 wherein said non-alphanumeric symbol indicates a cuisine.
- 98-100. (Cancelled)
101. A program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for incremental keyword search on a wireless user device, the method comprising:

receiving from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols;  
creating a single bit vector based at least in part on said input keyword string;  
comparing said bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors;  
applying a conventional keyword matching algorithm to said at least one candidate keyword string represented by said set of matching bit vectors; and  
presenting any matching candidate keyword strings.

102. The program storage device of claim 101 wherein said method further comprises preempting said method after a predetermined amount of time.

103. The program storage device of claim 102 wherein said predetermined amount of time is two seconds.

104. The program storage device of claim 101 wherein said comparing is independent of the order of keyword prefixes in keyword strings.

105. A program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for creating a keyword string database on a wireless user device, the method comprising:  
determining one or more candidate keyword strings to store in said database;

for each of said one or more candidate keyword strings, creating a single bit vector based at least in part on said each of said one or more candidate keyword strings, said bit vector having a bit position for each symbol in an alphabet and having bits set for bit positions corresponding to at least one symbol representing the first symbol of a word in said each of said one or more candidate keyword strings, said bit vectors for use in comparing an input bit vector with said bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings; and  
storing said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.

106. A program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for incremental keyword search on a wireless user device, the method comprising:  
submitting to said wireless user device an input keyword string comprising one or more words comprising one or more symbols; and  
receiving in response to said submitting at least one candidate keyword string where the first symbol of at least one word in each of said at least one candidate keyword string matches the first symbol of the corresponding word in said input keyword string.

107. The program storage device of claim 106 wherein said method further comprises preempting said method after a predetermined amount of time.



108. The program storage device of claim 107 wherein said predetermined amount of time is two seconds.

109. A program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for incremental keyword search on a wireless user device, the method comprising:  
receiving from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols;  
creating a single bit vector based at least in part on said input keyword string, said bit vector having a bit position for each symbol in an alphabet and having bits set for positions corresponding to at least one symbol representing the first symbol of a word in said input keyword string;  
comparing said bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors;  
applying a conventional keyword matching algorithm to said at least one candidate keyword string represented by said set of matching bit vectors; and  
presenting any matching candidate keyword strings.

110. The program storage device of claim 109 wherein said method further comprises preempting said method after a predetermined amount of time.

111. The program storage device of claim 110 wherein said predetermined amount of time is two seconds.

112. The program storage device of claim 109 wherein said comparing is independent of the order of keyword prefixes in keyword strings.

113. A program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for comparing keyword strings on a wireless user device, the method comprising:  
determining a relative frequency of use for at least one symbol in a language;  
assigning a statistical weighting to said at least one symbol based at least in part on a relative frequency of use of said at least one symbol;  
assigning each of said at least one symbol to one of a plurality of groups; and  
comparing a first keyword string and a second keyword string based at least in part on whether at least one symbol of said first keyword string is assigned to the same group as at least one corresponding symbol of said second keyword string.

114. The program storage device of claim 113 wherein said assigning further comprises assigning each of said at least one symbol to one of a plurality of groups so as to minimize the difference between the sums of statistical weightings for symbols comprising each group in said plurality of groups.

115. The program storage device of claim 113 wherein said relative frequency of use comprises the relative frequency of use of symbols in the first character of words in said language.

116. A program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for creating a keyword string database on a wireless user device, the method comprising:

determining one or more candidate keyword strings to store in said database;

creating one or more bit vectors based at least in part on said one or more candidate keyword strings, each bit of said one or more bit vectors corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to the first symbol of a word in said one or more candidate keyword strings being set, said one or more bit vectors for use in comparing an input bit vector with said one or more bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings; and

storing said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.

117-119. (Cancelled)

120. A program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for incremental keyword search on a wireless user device, the method comprising:

receiving from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string;

creating a single bit vector based at least in part on said input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to said one or more symbols being set;

comparing said bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors;

applying a conventional keyword matching algorithm to said at least one candidate keyword string represented by said set of matching bit vectors; and

presenting any matching candidate keyword strings.

121. The program storage device of claim 120 wherein said method further comprises preempting said method after a predetermined amount of time.

122. The program storage device of claim 121 wherein said predetermined amount of time is two seconds.

123. The program storage device of claim 120 wherein said comparing is independent of the order of keyword prefixes in keyword strings.

124. A program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for creating a keyword string database on a wireless user device, the method comprising:

determining one or more candidate keyword strings to store in said database;

creating one or more bit vectors based at least in part on said one or more candidate keyword strings, each bit of said one or bit vector corresponding to one or more symbols in an

alphabet, bits having a bit position corresponding to a symbol of a prefix of a word in said one or more candidate keyword strings being set, said one or more bit vectors for use in comparing an input bit vector with said one or more bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings; and  
storing said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.

125. A program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for incremental keyword search on a wireless user device, the method comprising:  
submitting an input keyword string comprising one or more words comprising one or more symbols; and  
receiving in response to said submitting at least one candidate keyword string where a prefix of a word of a matching candidate keyword string comprises at least one symbol that belongs to the same symbol group as the corresponding symbol of the corresponding word in said input keyword string.

126. The program storage device of claim 125 wherein said method further comprises preempting said method after a predetermined amount of time.

127. The program storage device of claim 126 wherein said predetermined amount of time is two seconds.

128. A program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for incremental keyword search on a wireless user device, the method comprising:
- receiving from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols;
- creating a single bit vector based at least in part on said input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to a prefix of a word in said one or more symbols being set;
- comparing said bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors;
- applying a conventional keyword matching algorithm to said at least one candidate keyword string represented by said set of matching bit vectors; and
- presenting any matching candidate keyword strings.
129. The program storage device of claim 128 wherein said method further comprises preempting said method after a predetermined amount of time.
130. The program storage device of claim 129 wherein said predetermined amount of time is two seconds.
131. The program storage device of claim 128 wherein said comparing is independent of the order of keyword prefixes in keyword strings.

132. A program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for incremental keyword search on a wireless user device, the method comprising:
- receiving from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string;
- receiving a hierarchy, elements of said hierarchy comprising intermediate nodes and leaf nodes representing one or more keyword strings comprising one or more words comprising one or more symbols;
- creating hierarchy bit vectors corresponding to said one or more keyword strings in said hierarchy;
- searching said hierarchy bit vectors for a match with said input keyword string, said searching comprising, for each of said elements of said hierarchy:
- saving said input keyword string;
- applying a logical “AND” operation to the bit vector of the element and a bit vector based at least in part on said input keyword string, said applying producing a result;
- if said result is nonzero, removing from said input keyword string any words in said input keyword string that are prefixes of words in the element;
- if said input keyword string is empty, adding said element to a list of matched items; and
- restoring said input keyword string; and
- rendering said list of matched items.

133. An apparatus for creating a keyword string database on a wireless user device, the apparatus comprising:
- means for determining one or more candidate keyword strings to store in said database;
  - means for, for each of said one or more candidate keyword strings, creating a single bit vector based at least in part on said each of said one or more candidate keyword strings, said bit vectors for use in comparing an input bit vector with said bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings, said input keyword string provided by a user of said wireless user device; and
  - means for storing said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.
134. The apparatus of claim 133 wherein said bit vector further comprises at least one bit that represents a non-alphanumeric symbol.
135. The apparatus of claim 134 wherein said non-alphanumeric symbol indicates an email address.
136. The apparatus of claim 134 wherein said non-alphanumeric symbol indicates a mobile number.
137. The apparatus of claim 134 wherein said non-alphanumeric symbol indicates a wired number.



138. The apparatus of claim 134 wherein said non-alphanumeric symbol indicates a paper-mail address.

139. The apparatus of claim 134 wherein said non-alphanumeric symbol indicates a cost ranking.

140. The apparatus of claim 134 wherein said non-alphanumeric symbol indicates a quality ranking.

141. The apparatus of claim 134 wherein said non-alphanumeric symbol indicates a cuisine.

142. An apparatus for incremental keyword search on a wireless user device, the apparatus comprising:

means for receiving from a user of said wireless user device an input keyword string

comprising one or more words comprising one or more symbols;

means for creating a single bit vector based at least in part on said input keyword string;

means for comparing said bit vector with one or more other bit vectors representing at least

one candidate keyword string to create a set of matching bit vectors;

means for applying a conventional keyword matching algorithm to said at least one

candidate keyword string represented by said set of matching bit vectors; and

means for presenting any matching candidate keyword strings.

143. The apparatus of claim 142, further comprising means for preempting said receiving, said creating, said comparing, said applying and said presenting after a predetermined amount of time.
144. The apparatus of claim 143 wherein said predetermined amount of time is two seconds.
145. The apparatus of claim 142 wherein said comparing is independent of the order of keyword prefixes in keyword strings.
146. An apparatus for creating a keyword string database on a wireless user device, the apparatus comprising:  
means for determining one or more candidate keyword strings to store in said database;  
means for, for each of said one or more candidate keyword strings, creating a single bit vector based at least in part on said each of said one or more candidate keyword strings, said bit vector having a bit position for each symbol in an alphabet and having bits set for bit positions corresponding to at least one symbol representing the first symbol of a word in said each of said one or more candidate keyword strings, said bit vectors for use in comparing an input bit vector with said bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings; and  
means for storing said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.

147. An apparatus for incremental keyword search on a resource-constrained device, the apparatus comprising:
- means for receiving from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols;
  - means for creating a single bit vector based at least in part on said input keyword string, said bit vector having a bit position for each symbol in an alphabet and having bits set for positions corresponding to at least one symbol representing the first symbol of a word in said input keyword string;
  - means for comparing said bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors;
  - means for applying a conventional keyword matching algorithm to said at least one candidate keyword string represented by said set of matching bit vectors; and
  - means for presenting any matching candidate keyword strings.
148. The apparatus of claim 147, further comprising means for preempting said receiving, said creating, said comparing, said applying and said presenting after a predetermined amount of time.
149. The apparatus of claim 148 wherein said predetermined amount of time is two seconds.
150. The apparatus of claim 147 wherein said comparing is independent of the order of keyword prefixes in keyword strings.

151. An apparatus for comparing keyword strings on a wireless user device, the apparatus comprising:
- means for determining a relative frequency of use for at least one symbol in a language;
  - means for assigning a statistical weighting to said at least one symbol based at least in part on a relative frequency of use of said at least one symbol;
  - means for assigning each of said at least one symbol to one of a plurality of groups; and
  - means for comparing a first keyword string and a second keyword string based at least in part on whether at least one symbol of said first keyword string is assigned to the same group as at least one corresponding symbol of said second keyword string.
152. The apparatus of claim 151 wherein said means for assigning further comprises means for assigning each of said at least one symbol to one of a plurality of groups so as to minimize the difference between the sums of statistical weightings for symbols comprising each group in said plurality of groups.
153. The apparatus of claim 151 wherein said relative frequency of use comprises the relative frequency of use of symbols in the first character of words in said language.
154. An apparatus for creating a keyword string database on a wireless user device, the apparatus comprising:
- means for determining one or more candidate keyword strings to store in said database;
  - means for creating one or more bit vectors based at least in part on said one or more candidate keyword strings, each bit of said one or more bit vectors corresponding to one

or more symbols in an alphabet, bits having a bit position corresponding to the first symbol of a word in said one or more candidate keyword strings being set, said one or more bit vectors for use in comparing an input bit vector with said one or more bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings; and  
means for storing said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.

155. An apparatus for incremental keyword search on a wireless user device, the apparatus comprising:

means for receiving from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string;  
means for creating a single bit vector based at least in part on said input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to said one or more symbols being set;  
means for comparing said bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors;  
means for applying a conventional keyword matching algorithm to said at least one candidate keyword string represented by said set of matching bit vectors; and  
means for presenting any matching candidate keyword strings.

156. The apparatus of claim 155, further comprising means for preempting said receiving, said creating, said comparing, said applying and said presenting after a predetermined amount of time.
157. The apparatus of claim 156 wherein said predetermined amount of time is two seconds.
158. The apparatus of claim 155 wherein said comparing is independent of the order of keyword prefixes in keyword strings.
159. An apparatus for creating a keyword string database on a wireless user device, the apparatus comprising:  
means for determining one or more candidate keyword strings to store in said database;  
means for creating one or more bit vectors based at least in part on said one or more candidate keyword strings, each bit of said one or bit vector corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to a symbol of a prefix of a word in said one or more candidate keyword strings being set, said one or more bit vectors for use in comparing an input bit vector with said one or more bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings; and  
means for storing said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.

160. An apparatus for incremental keyword search on a wireless user device, the apparatus comprising:
- means for receiving from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols;
  - means for creating a bit vector based at least in part on said input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to a prefix of a word in said one or more symbols being set;
  - means for comparing said bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors;
  - means for applying a conventional keyword matching algorithm to said at least one candidate keyword string represented by said set of matching bit vectors; and
  - means for presenting any matching candidate keyword strings.
161. The apparatus of claim 160, further comprising means for preempting said said receiving, said creating, said comparing, said applying and said presenting after a predetermined amount of time.
162. The apparatus of claim 161 wherein said predetermined amount of time is two seconds.
163. The apparatus of claim 160 wherein said comparing is independent of the order of keyword prefixes in keyword strings.

164. An apparatus for incremental keyword search on a wireless user device, the apparatus comprising:

- means for receiving from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string;
- means for receiving a hierarchy, elements of said hierarchy comprising intermediate nodes and leaf nodes representing one or more keyword strings comprising one or more words comprising one or more symbols;
- means for creating hierarchy bit vectors corresponding to said one or more keyword strings in said hierarchy;
- means for searching said hierarchy bit vectors for a match with said input keyword string, said means for searching comprising, for each of said elements of said hierarchy:
- means for saving said input keyword string;
- means for applying a logical “AND” operation to the bit vector of the element and a bit vector based at least in part on said input keyword string, said applying producing a result;
- means for if said result is nonzero, removing from said input keyword string any words in said input keyword string that are prefixes of words in the element;
- means for if said input keyword string is empty, adding said element to a list of matched items; and
- means for restoring said input keyword string; and
- means for rendering said list of matched items.



165. An apparatus for creating a keyword string database on a wireless user device, the apparatus comprising:
- a memory for storing said keyword string database; and
  - a processor configured to:
    - determine one or more candidate keyword strings to store in said database;
    - for each of said one or more candidate keyword strings, create a single bit vector based at least in part on said each of said one or more candidate keyword strings, said bit vectors for use in comparing an input bit vector with said bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings, said input keyword string provided by a user of said wireless user device; and
    - store said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.
166. The apparatus of claim 165 wherein said bit vector further comprises at least one bit that represents a non-alphanumeric symbol.
167. The apparatus of claim 166 wherein said non-alphanumeric symbol indicates an email address.
168. The apparatus of claim 166 wherein said non-alphanumeric symbol indicates a mobile number.

169. The apparatus of claim 166 wherein said non-alphanumeric symbol indicates a wired number.

170. The apparatus of claim 166 wherein said non-alphanumeric symbol indicates a paper-mail address.

171. The apparatus of claim 166 wherein said non-alphanumeric symbol indicates a cost ranking.

172. The apparatus of claim 166 wherein said non-alphanumeric symbol indicates a quality ranking.

173. The apparatus of claim 166 wherein said non-alphanumeric symbol indicates a cuisine.

174. An apparatus for incremental keyword search on a wireless user device, the apparatus comprising:

a user interface configured to receive from a user of said wireless user device an input

keyword string comprising one or more words comprising one or more symbols, said

user interface further configured to present any matching keyword strings; and

a search engine in communication with said user interface and configured to:

create a single bit vector based at least in part on said input keyword string;

compare said bit vector with one or more other bit vectors representing at least one

candidate keyword string to create a set of matching bit vectors; and

apply a conventional keyword matching algorithm to said at least one candidate keyword string represented by said set of matching bit vectors.

175. The apparatus of claim 174 wherein said apparatus is further configured to preempt said search engine after a predetermined amount of time.

176. The apparatus of claim 175 wherein said predetermined amount of time is two seconds.

177. The apparatus of claim 174 wherein said apparatus is further configured to compare said bit vector independent of the order of keyword prefixes in keyword strings.

178. An apparatus for creating a keyword string database on a wireless user device, the apparatus comprising:

a memory for storing said keyword string database; and

a processor configured to:

determine one or more candidate keyword strings to store in said database;

for each of said one or more candidate keyword strings, create a single bit vector based at

least in part on said each of said one or more candidate keyword strings, said bit vector

having a bit position for each symbol in an alphabet and having bits set for bit positions

corresponding to at least one symbol representing the first symbol of a word in said

each of said one or more candidate keyword strings, said bit vectors for use in

comparing an input bit vector with said bit vectors to indicate whether an input keyword

string represented by said input bit vector matches said one or more candidate keyword strings; and

store said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.

179. An apparatus for incremental keyword search on a wireless user device, the apparatus comprising:

a user interface configured to receive from a user of said wireless user device an input

keyword string comprising one or more words comprising one or more symbols, said

user interface further configured to present any matching keyword strings; and

a search engine in communication with said user interface and configured to:

create a single bit vector based at least in part on said input keyword string, said bit vector

having a bit position for each symbol in an alphabet and having bits set for positions

corresponding to at least one symbol representing the first symbol of a word in said

input keyword string;

compare said bit vector with one or more other bit vectors representing at least one

candidate keyword string to create a set of matching bit vectors; and

apply a conventional keyword matching algorithm to said at least one candidate keyword

string represented by said set of matching bit vectors.

180. The apparatus of claim 179 wherein said apparatus is further configured to preempt said search engine after a predetermined amount of time.

181. The apparatus of claim 180 wherein said predetermined amount of time is two seconds.

182. The apparatus of claim 179 wherein said apparatus is further configured to compare said bit vector independent of the order of keyword prefixes in keyword strings.

183. An apparatus for comparing keyword strings on a wireless user device, the apparatus comprising:

a memory for storing at least one relative frequency of use for at least one symbol in a language; and

a processor configured to:

determine a relative frequency of use for at least one symbol in a language;

assign a statistical weighting to said at least one symbol based at least in part on a relative frequency of use of said at least one symbol;

assign each of said at least one symbol to one of a plurality of groups; and

compare a first keyword string and a second keyword string based at least in part on whether at least one symbol of said first keyword string is assigned to the same group as at least one corresponding symbol of said second keyword string.

184. The apparatus of claim 183 wherein said processor is further configured to assign each of said at least one symbol to one of a plurality of groups so as to minimize the difference between the sums of statistical weightings for symbols comprising each group in said plurality of groups.

185. The apparatus of claim 183 wherein said relative frequency of use comprises the relative frequency of use of symbols in the first character of words in said language.

186. An apparatus for creating a keyword string database on a wireless user device, the apparatus comprising:

a memory for storing said keyword string database; and

a processor configured to:

determine one or more candidate keyword strings to store in said database;

create one or more bit vectors based at least in part on said one or more candidate keyword

strings, each bit of said one or more bit vectors corresponding to one or more symbols

in an alphabet, bits having a bit position corresponding to the first symbol of a word in

said one or more candidate keyword strings being set, said one or more bit vectors for

use in comparing an input bit vector with said one or more bit vectors to indicate

whether an input keyword string represented by said input bit vector matches said one

or more candidate keyword strings; and

store said one or more bit vectors and a reference to said one or more candidate keyword

strings in said database.

187. An apparatus for incremental keyword search on a wireless user device, the apparatus

comprising:

a user interface configured to receive from a user of said wireless user device an input

keyword string comprising one or more words comprising one or more symbols, each

symbol representing the first symbol of a word in a search string, said user interface

further configured to present any matching keyword strings; and

a search engine in communication with said user interface and configured to:

create a single bit vector based at least in part on said input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to said one or more symbols being set;

compare said bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors; and

apply a conventional keyword matching algorithm to said at least one candidate keyword string represented by said set of matching bit vectors.

188. The apparatus of claim 187 wherein said apparatus is further configured to preempt said search engine after a predetermined amount of time.

189. The apparatus of claim 188 wherein said predetermined amount of time is two seconds.

190. The apparatus of claim 187 wherein said apparatus is further configured to compare said bit vector independent of the order of keyword prefixes in keyword strings.

191. An apparatus for creating a keyword string database on a wireless user device, the apparatus comprising:

a memory for storing said keyword string database; and

a processor configured to:

determine one or more candidate keyword strings to store in said database;

create one or more bit vectors based at least in part on said one or more candidate keyword strings, each bit of said one or bit vector corresponding to one or more symbols in an

alphabet, bits having a bit position corresponding to a symbol of a prefix of a word in said one or more candidate keyword strings being set, said one or more bit vectors for use in comparing an input bit vector with said one or more bit vectors to indicate whether an input keyword string represented by said input bit vector matches said one or more candidate keyword strings; and  
store said one or more bit vectors and a reference to said one or more candidate keyword strings in said database.

192. An apparatus for incremental keyword search on a wireless user device, the apparatus comprising:  
a user interface configured to receive from a user of said wireless user device an input keyword string comprising one or more words comprising one or more symbols, said user interface further configured to present any matching keyword strings; and  
a search engine in communication with said user interface and configured to:  
create a bit vector based at least in part on said input keyword string, each bit corresponding to one or more symbols in an alphabet, bits having a bit position corresponding to a prefix of a word in said one or more symbols being set;  
compare said bit vector with one or more other bit vectors representing at least one candidate keyword string to create a set of matching bit vectors; and  
apply a conventional keyword matching algorithm to said at least one candidate keyword string represented by said set of matching bit vectors.



193. The apparatus of claim 192 wherein said apparatus is further configured to preempt said search engine after a predetermined amount of time.

194. The apparatus of claim 193 wherein said predetermined amount of time is two seconds.

195. The apparatus of claim 192 wherein said apparatus is further configured to compare said bit vector independent of the order of keyword prefixes in keyword strings.

196. An apparatus for incremental keyword search on a wireless user device, the apparatus comprising:

a user interface configured to receive from a user of said wireless user device an input

keyword string comprising one or more words comprising one or more symbols, said

user interface further configured to present any matching keyword strings; and

a search engine in communication with said user interface and configured to:

receive an input keyword string comprising one or more words comprising one or more symbols, each symbol representing the first symbol of a word in a search string;

receive a hierarchy, elements of said hierarchy comprising intermediate nodes and leaf nodes representing one or more keyword strings comprising one or more words comprising one or more symbols;

create hierarchy bit vectors corresponding to said one or more keyword strings in said hierarchy;

search said hierarchy bit vectors for a match with said input keyword string, said apparatus further configured to, for each of said elements of said hierarchy:

save said input keyword string;  
apply a logical “AND” operation to the bit vector of the element and a bit vector based at least in part on said input keyword string, said applying producing a result;  
if said result is nonzero, remove from said input keyword string any words in said input keyword string that are prefixes of words in the element;  
if said input keyword string is empty, add said element to a list of matched items; and  
restoring said input keyword string; and  
render said list of matched items; and  
apply a conventional keyword matching algorithm to said at least one keyword string represented by one or more element in said list of matched items.

197. A method for comparing keyword strings on a wireless user device, the method comprising:  
assigning each of at least one symbol in a language to one of a plurality of groups; and  
comparing a first keyword string and a second keyword string based at least in part on whether at least one symbol of said first keyword string is assigned to the same group as at least one corresponding symbol of said second keyword string.

198. The method of claim 197 wherein said plurality of groups corresponds with a telephone keyboard symbol grouping.

199. A method for comparing keyword strings on a wireless user device, the method comprising:  
step for assigning each of at least one symbol in a language to one of a plurality of groups;  
and

step for comparing a first keyword string and a second keyword string based at least in part on whether at least one symbol of said first keyword string is assigned to the same group as at least one corresponding symbol of said second keyword string.

200. The method of claim 199 wherein said plurality of groups corresponds with a telephone keyboard symbol grouping.

201. A program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for comparing keyword strings on a wireless user device, the method comprising:  
assigning each of at least one symbol in a language to one of a plurality of groups; and  
comparing a first keyword string and a second keyword string based at least in part on whether at least one symbol of said first keyword string is assigned to the same group as at least one corresponding symbol of said second keyword string.

202. The program storage device of claim 201 wherein said plurality of groups corresponds with a telephone keyboard symbol grouping.

203. An apparatus for comparing keyword strings on a wireless user device, the apparatus comprising:  
means for assigning each of at least one symbol in a language to one of a plurality of groups;  
and

means for comparing a first keyword string and a second keyword string based at least in part on whether at least one symbol of said first keyword string is assigned to the same group as at least one corresponding symbol of said second keyword string.

204. The apparatus of claim 203 wherein said plurality of groups corresponds with a telephone keyboard symbol grouping.

205. An apparatus for comparing keyword strings on a wireless user device, the apparatus comprising:  
a memory for storing said keyword strings; and  
a processor configured to:  
assign each of at least one symbol in a language to one of a plurality of groups; and  
compare a first keyword string and a second keyword string based at least in part on whether at least one symbol of said first keyword string is assigned to the same group as at least one corresponding symbol of said second keyword string.

206. The apparatus of claim 205 wherein said plurality of groups corresponds with a telephone keyboard symbol grouping.

**Evidence Appendix**

None.

**Related Proceedings Appendix**

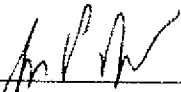
None.

Please charge any additional required fee or credit any overpayment not otherwise paid  
or credited to our deposit account No. 50-1698.

Respectfully submitted,

THELEN REID BROWN RAYSMAN & STEINER, LLP

Dated: June 30, 2008

  
\_\_\_\_\_  
John P. Schaub  
Reg. No. 42,125

THELEN REID BROWN RAYSMAN & STEINER, LLP  
P.O. Box 640640  
San Jose, CA 95164-0640  
Tel. (408) 292-5800  
Fax. (408) 287-8040